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THE TEMPLE PRIMERS

FIRST AID TO THE INJURED AND AMBULANCE DRILL

By

H. DRINKWATER, M.D.



PROFESSOR ESMARCH

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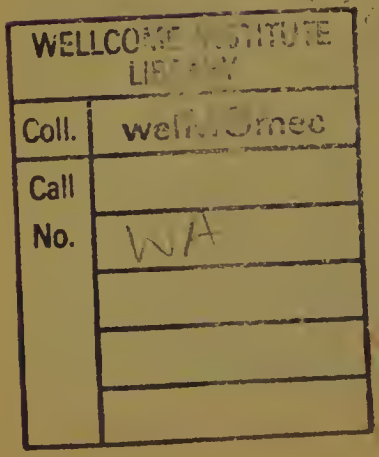
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PREFACE

Whilst acknowledging that there are a few excellent works on "First Aid" already before the public, my experience as an examiner and instructor of ambulance classes—extending over a period of nearly twenty years—has convinced me that there is still a *want*, which it is the aim of the following pages to supply.

Some of the works are too full of theoretical matter.

In my own lectures my endeavour is always to make the instruction as *practical* as possible, to omit all anatomical and physiological details that do not bear directly upon the practical work of the syllabus, and to lay special stress upon those points which are essential for an intelligent comprehension of the subject.

In no work already published do all the *illustrations* appear to me to be quite satisfactory, and certainly some of them are incorrect and misleading.

These Lectures are published in the hope that they may be found useful, not only to those in attendance on a course of ambulance lectures, but also to others who may not be fortunate enough to have the benefit of the instruction which these classes afford.

H. D.

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FIRST AID TO THE INJURED.

PART I.

First Aid Lectures aim at teaching what should be done in cases of injury and sudden illness, and especially what should be done *first* before the surgeon arrives.

Let me at once give an illustration. I once saw a man who was cut on the temple by a piece of glass. The wound was only a quarter of an inch long, but the man almost died from loss of blood; for, though there were many men near him, not one knew what to do to stop the bleeding. Before reaching my surgery, only 300 yards away, he had lost so much blood that his life was in great danger.

Any one could have arrested the bleeding simply by pressing the tip of the finger on the wound, and this should have been done and the wound bandaged *before* bringing the man to me. This immediate treatment is what is meant by *First Aid.*

It is in cases of everyday accidents, such as bleeding, wounds, broken bones, fits, burns, and scalds, and less frequently poisoning and drowning, that "First Aid" pupils may render such valuable help. Timely and skilful First Aid may save much pain, as in fractures and burns, and may even save life, by preventing loss of blood from wounds, and giving prompt help in cases of drowning, poisoning, &c.

My aim is to place the subject before you in as clear

a form as possible, and to tell you only what is actually necessary to enable you to understand the subject thoroughly.

The commonest accident you may be called to is a wound of some part of the body, and you will be required to stop the bleeding. The precise treatment depends upon the part that is injured, and whether the bleeding is "arterial" or "venous."

Thus it is quite clear that some knowledge of the different parts that make up our bodies is necessary before you can render aid in many cases of injury. This preliminary study will to most students be the least interesting part of this course of instruction, but as the practical part cannot be understood without it, you must resolve on mastering it before proceeding further.

The Bones.—That part of the body which forms the support for all the rest is the bony framework or **Skeleton**. You must makè yourself familiar with the drawings of those portions of the skeleton shown in Figs. 1 to 7, and you will learn much by feeling, as far as possible, the shape of the bones of your own body whilst looking at the figure and comparing one with the other. You may learn the anatomical names of the bones if you like, but need not try to remember them at first.

Let us glance over the chief points to be observed about the bones.

First of all you will notice that the bones in different parts of the body vary very much in shape and size. Some are *long bones*, such as those of the thigh, leg, upper and fore arm, and ribs; others are *small*, such as in the wrist and instep; whilst others, again, are broad, flat, and *plate-like*, as in the skull, shoulder-blade, and hip.

The Skull (Fig. 1).—Notice particularly that although there are in infancy twenty-two *separate* bones forming the head and face, in the adult all are united, forming, as it were, only one complex bone, with the exception of the lower

jaw, which can be moved independently of the other bones of the head. The place of union is marked by what are called sutures, which, in the infant, are more or less open spaces, through which the pulsations of the brain can be easily felt.

The eight bones forming the upper part of the head (Brain-box or "Cranium") would be very easily broken



FIG. 1.—THE SKULL.

s s Lines showing where the bones have united (sutures).
c The tip of the nose, formed of gristle.

if they were quite *flat*, but their arched form makes them very strong, and thus they afford great protection to the brain below. The head rests on the top of **the Back-bone or Spine.**

This consists of a flexible chain of bones, placed one above the other, the uppermost being in contact with the head. The separate bones can be felt in the groove running in a straight line down the middle of the neck and back. The cavity in the head which contains the brain is continuous with a canal running within the backbone from the top to the bottom. This canal contains a structure called the *Spinal Cord*, a most important part of the nervous system.

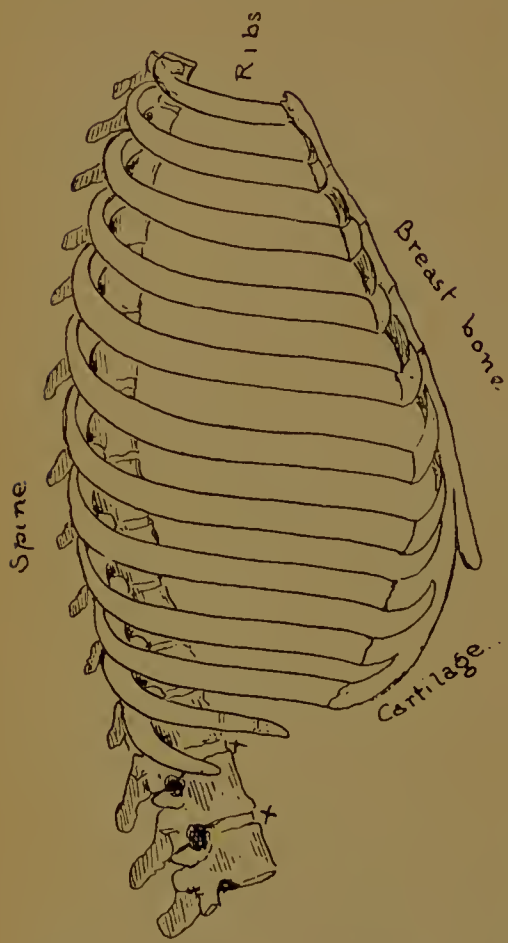


FIG. 2.—Ribs as seen from the right side. Fourteen segments of the Spine are shown. *x x* Cartilage between the segments.

Attached to that part of the backbone belonging to the chest there are a number of **ribs**, twelve on each side, forming twelve symmetrical pairs, the upper ten pairs being connected with the **breastbone** in front, but not directly, for each rib stops short some little distance from this

bone, and terminates in a piece of **cartilage** or gristle which connects it with the breastbone. This gristle possesses many of the properties of bone, but is *flexible*. If it were not for these pieces of gristle the ribs could scarcely be moved, or the chest expanded, in breathing. Wherever two bones come into close connection the ends are covered with cartilage, a substance so perfectly smooth that the surfaces can move over one another without any appreciable amount of friction or grating. If, then, any grating sensation is felt on moving a joint we know that something is wrong with the joint. The cartilages between the segments of the spine are so soft that they act like buffers (*x x* in Fig. 2).

It is well to compare the bones of the upper limbs with those of the lower. Those of the **upper limb** are smaller, and possess much more freedom of movement than those of the **lower limb**.

See how freely the arm can be moved in all directions at the shoulder-joint in comparison with the movement of the leg at the hip. There are two bones placed side by side in the forearm, and there are two in the leg (Fig. 5), from the knee to the ankle. We can bend the limb at the elbow or at the knee, and straighten them again. (Flexion and Extension.) This is *all* the movement that can take place at the *knee*, but the forearm has another kind of movement as well. Place the forearm, with the palm of the hand turned upwards, on a table, and feel the inner of the two bones of the forearm (Ulna). The upper end forms the tip of the elbow. The bone can be easily felt right down to the *inner* side of the wrist. Now turn the palm downwards, keeping the elbow as before, and you will find the tip of the elbow in exactly the same position, whilst the lower end of the Ulna is now at the *outer* side of the wrist. That is because the *outer* of the two bones rotates round the *inner* one in such a way that its *lower* end crosses in front of the inner bone. When examining in case of injury let the palm be forwards, so that the bones are lying side by side.

The bones of the hand, too, are much more movable

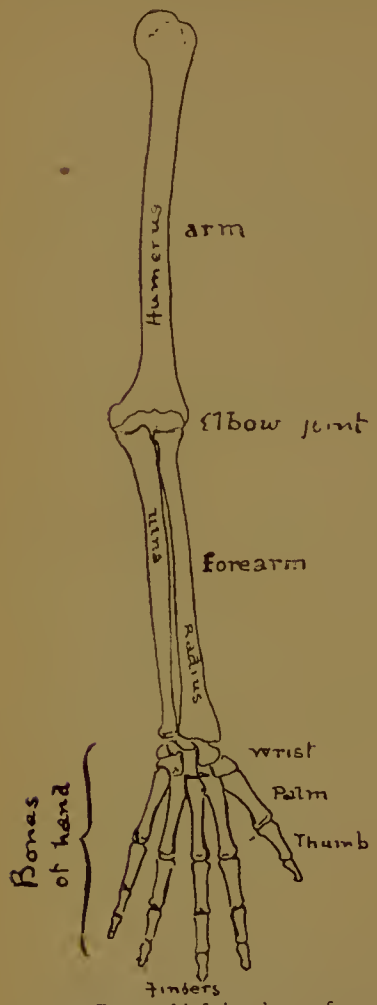


FIG. 3.—Bones of left hand seen from the front. The palm is looking forwards.

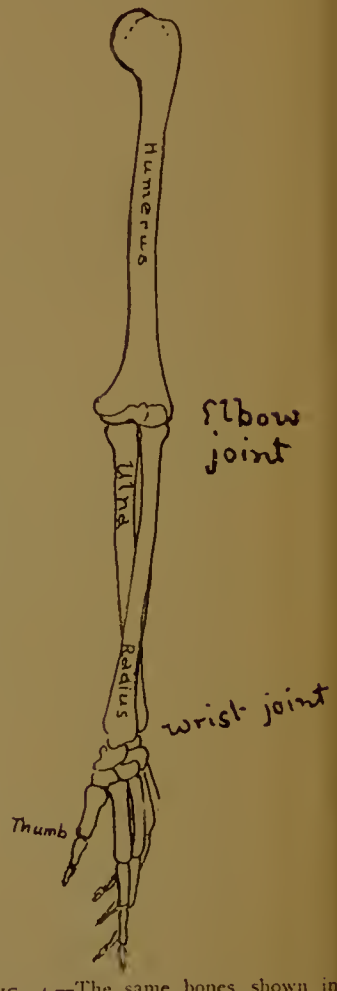


FIG. 4.—The same bones shown in Fig. 3 but with the palm looking inwards.

than those of the foot. There are eight very small bones

at the wrist. The corresponding bones in the foot, seven in number, are much larger, and form the heel and instep.

Notice that there is a small circular bone in front of the knee, called the **knee-cap**, on which we rest in kneeling. You can easily move it up and down with the hand when the leg is at rest and extended.

Now observe the enormous difference between the bones forming the *shoulder* and those forming the hips (or pelvis). The former (Fig. 6) are two in number, the **collar-bone** passing in front and the **shoulder-blade** behind. The inner end of the collar-bone is jointed on the upper corner of the breastbone, so that the whole limb hangs on this small movable joint.

The leg is connected with the spine by the enormous **hip-bones** (Figs. 5 and 7), forming a large basin-shaped mass called the **Pelvis.**

The joints between this mass and the spine are immovable. The result of this difference is that the lower limbs are strong and well adapted for supporting the entire weight of the body. The arms, on the other hand, are

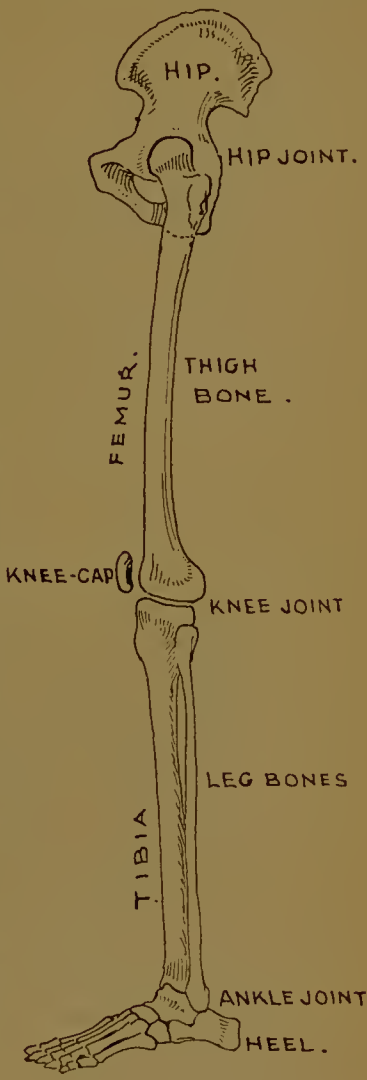


FIG. 5.—Bones of left leg (outer view).

not adapted for support, but possess the advantage of a great range of movement.

Bones give support and protect structures such as the

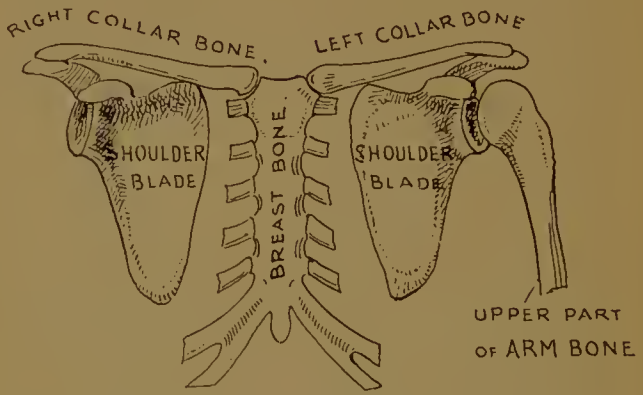


FIG. 6.—Showing how the arm is suspended on the collar-bone. (The ribs have been removed, except the ends attached to the breastbone.)

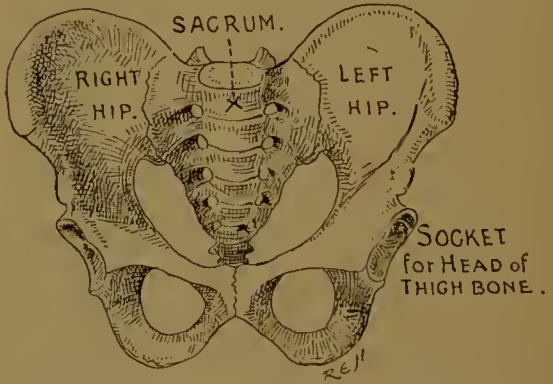


FIG. 7.—Front view of pelvis, composed of two hip-bones and lowest portion of the spine, called "sacrum."

Brain, Heart, Lungs, Liver, &c. How are they moved? By means of **Muscles.**

Muscles are bands of flesh passing from one bone to

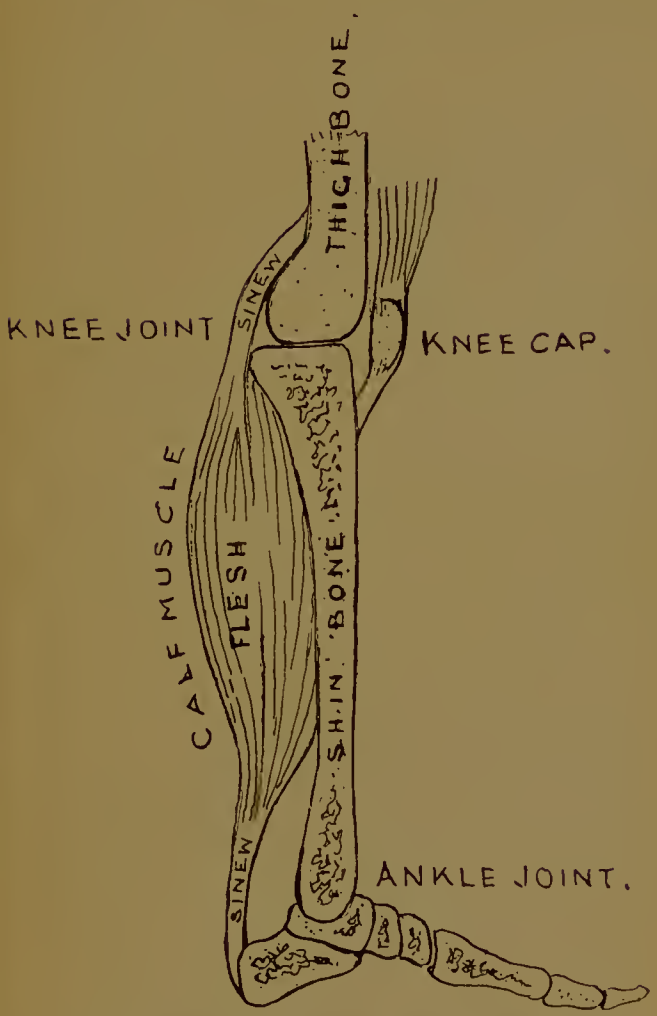


FIG. 8.—Showing the calf muscle and its attachments.

another *across a joint*. They are only attached to bone at

each end (by a *sinew* or *tendon*), and are free (that is, unattached to bone) in the intermediate fleshy portion. As a rule they are arranged in two separate lots, one lot passing in front of the joint and the other behind. Those that pass in front draw the lower bone forwards, and those behind draw it backwards. They have a constant *tendency to contract* or shorten themselves. A knowledge of this fact is useful when setting a broken bone, for it is necessary to prevent the muscles drawing the broken ends into a bad position.

The muscles that bend the arm at the elbow are placed in front and are called *Flexors*, those that straighten or extend it are situated behind and are called *Extensors*. Feel the mass of flesh in front of the upper arm and notice how it thickens and hardens when you bend the elbow. Feel how the muscles in the front of the thigh harden when the knee is raised.

Nerves.—The muscles are made to contract by the nerves. These are very fine threads that pass all the way from the Brain and Spinal Cord to every muscle in the body. If a nerve be cut across no effort of the will can make the muscle to which it goes contract. When a muscle loses its power of contraction, from whatever cause, it is said to be *paralysed*, and the disease or injury causing the paralysis may be situated in the nerve in any part of its course, or in the Spinal Cord or Brain.

There are many nerves in the body besides those that pass to the muscles. Some go to the skin and transmit sensory impressions, or, in other words, enable you to *feel*, whilst others are connected with the special senses of Sight, Hearing, Taste, and Smell. Most nerves going from the brain to different parts of the body pass through the spinal cord, which they leave in pairs at regular intervals throughout its entire length. If the spine be injured so that the cord is pressed upon, all the muscles supplied by nerves leaving the cord below the seat of injury are paralysed, and sensation is entirely lost in the same area. Nerves do not

move in order to put muscles into action, but a current travels along them from the Brain or Spinal Cord, somewhat in the same way that electricity travels along telegraph wires.

THE BLOOD AND BLOOD-VESSELS.

Bones are moved by muscles, muscles are under the control of nerves, and all parts of the body depend for their life upon the blood.

The blood feeds every part of the body, and if any tissue is deprived of blood for more than a very short time it will die or "mortify."

The body, as a whole, is continuously changing, during infancy, childhood, adult life, and old age until death. Every part of the body has a life of its own, a life the duration of which is very short compared with that of the whole body.

The body requires a constant supply of *food*, liquid and solid, taken in by the mouth, *and air*, taken in by the lungs, just as the steam-engine must be constantly supplied with fuel and water; and as the food is required by every minute part of the body, there must be some means of satisfying this need.

How does it arrive at all parts? The food is first of all digested. Then it is absorbed in a liquid form from the *Digestive Organs* and carried dissolved in the blood along a marvellous system of tubes or *blood-vessels*. Most of them are so fine that they are called *Capillaries* (which means hair-like), but they are very, very much finer than the finest hair, for they can only be seen by the aid of a powerful microscope. They are indeed so small, and so abundantly distributed, that a fine needle pushed into any part of the body will cut through immense numbers of them.

The blood contains everything required for the nutrition of all the tissues or structures of the body, but the food contained in it is used up by the tissues so rapidly, that the

blood in any given part soon becomes unable to supply its need, and must pass on and be replaced by a fresh supply of blood. This is accomplished by the movement of the blood through the capillaries in a continuous stream, like an ever-flowing river. Thus the tissues are furnished with a constant supply of nutritive material (see Fig. 9).

The food absorbed by the tissues become so changed that very soon it requires to be removed again to make way for fresh material. This removal of waste products is also done by the blood whilst passing through the capillaries.

Now let us follow the blood in its course through a capillary, say at the tip of the finger. It does not go more than a very short distance before the capillary tube is joined by another one similar to it. A little farther on it is joined by others, and now we notice the hollow tube is larger, and each tube that joins it is larger and larger as we pass onwards, until by the time we have arrived at the middle of the finger the vessels are large enough to be seen by the naked eye. They still increase in size as the blood passes up the arm, and some can be seen forming those blue lines under the skin called *veins*. If you follow the blood still onward it will be found at last to arrive at a *very* important part, the ***Heart,*** situated in the chest. Now remember that if you trace the course of the blood from *any* capillary in the body you eventually arrive at the heart, and pass through similar tubes to those just described, namely, veins, which become larger and larger the nearer you approach the heart. You have noticed that the veins in the arm are blue. The colour is that of the blood passing through them. It is very important to remember these two facts—first, that *veins contain dark purple blood ;* and, second, that the blood in the veins is *moving towards the heart.*

Does the blood stop when it gets to the heart? By no means. Follow it onwards and you will find that it passes through the heart (which is hollow), leaving it by a large tube called an *artery*, about the same size as the vein by

which it arrived. This tube very soon begins to divide into smaller and smaller tubes, in the same way that you would see the veins divide if you were to follow them backwards from the heart towards the capillaries. Follow that tube (artery), going from the heart to the arm. At the upper part of the arm you will find it lying alongside a large vein and getting smaller towards the elbow, because of its having given off numerous branches in its course down the arm; but even when it reaches the wrist it is still large enough to be seen, and can be felt pulsating just underneath the skin. This beating or pulsation is what is known as the *Pulse*, and there is a pulse in every artery in the body. Follow the small branch going to the finger, and you will find by the time you have arrived at the tip the vessel is no longer visible to the naked eye. In fact, it terminates in capillaries like that where you commenced to trace the course of the veins.

If you follow *any* branch or division of one of these arteries leading from the heart, you will find it always terminates, in every part of the body, in capillaries. You have thus made a sort of circular tour; you began at a capillary, passed along the veins to the heart, and from the heart along the arteries back again to the capillaries. The movement of the blood through this circuit is known as the *circulation of the blood.*

The vessels by which the blood passes *from* the heart *to* the capillaries are called *Arteries;* those by which it *returns from* the capillaries *to* the heart are called *Veins.*

Definition of Artery and Vein.—*An Artery* is a vessel that *conveys blood* in a direction *away from the heart.*

A Vein is a vessel that *conveys blood* in a direction *towards the heart.* See the direction in which the arrow points in Figs. 9, 31, 32.

Thus every part of the body is supplied with blood coming along the arteries from the heart, and from which it again returns to the heart by the veins. The arteries are

like the system of water-pipes leading from the waterworks to all the houses of a town. If it were carried back to the reservoir by another system of pipes, these would represent the veins of the body; and just as the waterworks are supposed to distribute pure water to every household, so the heart sends pure blood along the arteries to every part of the body. This blood is of a bright scarlet colour, quite different in appearance to that contained in the veins. It is very important to remember this difference in colour when you come to treat a case of severe bleeding. Later on we shall see to what this colour is due. The blood in the arteries, then, is of a bright *scarlet* colour, and moving *away* from the heart. The blood in the veins is of a dark *blue* colour, and moving *towards* the heart.

The blood, as before stated, contains two classes of substances in solution, differing very widely from each other. The first class consists of material that is intended to serve as food for the tissues, including *Oxygen Gas*. The other class consists of waste material that it is bringing away from the tissues, including *Carbonic Acid Gas*. The foods are supplied to it by the *Organs of Digestion* (stomach, liver, &c.), and the *Organs of Respiration* (the lungs); the waste products are removed from the blood by the *Organs of Excretion* (skin, kidneys, liver, and lungs).

Respiration.—It is scarcely necessary for your present purpose to learn anything about the digestive organs or excretory organs, with one important exception, and that is the *Lungs*. These organs are of vital importance, and if their function (use) be interfered with to any great extent, death may rapidly occur from suffocation (asphyxia). Get a little clear lime-water, and blow into it through a small glass tube. The water will rapidly become milky-looking. Now add a few drops of Nitric or Hydrochloric Acid, and the water will again become clear, with small bubbles of gas escaping from it. This gas is what has been taken up from your breath by the lime in the water,

and shows that the air we breathe out differs in some respects from what we breathe in. *We breathe out a highly poisonous gas;* so poisonous, indeed, that it must be removed as rapidly as it is formed. It will be well to remember the name of this gas. It is *Carbonic Acid Gas.* How is it that there is so much Carbonic Acid gas in the lungs? This gas is the *chief waste product* carried off by the blood from the tissues, and the construction of the lungs is such that they are able to rid the blood of this impurity as rapidly as it passes into it, so that it is impossible, in health, for it to accumulate in the blood beyond a certain amount. This is the meaning of *Respiration* or breathing. The lungs are constantly receiving this gas from the blood, and the movements of the chest in respiration enable them to give it up to the external air. Pure air is taken into the lungs when we inspire, the Carbonic Acid mixes up with it, and when the air is expired it leaves the lungs along with the air that has just been taken in.

The lungs are hollow; they are often called spongy, and are capable of holding more or less air, as a sponge is of holding more or less water. When the chest is expanded the lungs are full of air; when it is contracted they contain much less air.

The proper entrance for the air is the *nose* (not the mouth); from this the air passes through the throat and into a large tube called the *Windpipe.* It is so important that the windpipe should be constantly open for the free passage of air that the upper part, the entrance, is made up chiefly of portions of cartilage. These cartilages form the prominence in the middle line of the neck popularly known as "*Adam's Apple.*" You can feel a notch at its upper edge. Place your finger here; notice that it descends lower in the neck every time you take a deep breath. Now swallow, and you will find that it suddenly moves upwards and forwards. This movement brings the opening, which communicates freely with the throat, right under the tongue,

and thus prevents any food, solid or liquid, dropping through this opening into the windpipe. Sometimes a little does get in, and then a violent cough comes on, to expel the substance that has tried to go "the wrong way." The windpipe soon divides into two large branches, one to the right and the other to the left lung. Each branch divides again and again ("Bronchial tubes"), until at last the branches end in the spongy part of the lungs called the *Air-Cells*. If you could imagine the stalk of a bunch of grapes to be hollow, and the grapes to consist of nothing but the thin outer skin, that would give you some idea of the structure of the air-cells of the lungs; only the air-cells are very small. You recollect that the blood returning to the heart is impure, the chief impurity being Carbonic Acid. It is necessary now to know that the heart is not a simple bag or ball, with a single cavity or chamber, but that it is divided by a partition in the middle in such a way that there are *two separate cavities* or chambers, a right chamber and a left chamber. The impure or "venous" blood is poured into the right chamber; and in order that it may be rid of its Carbonic Acid as quickly as possible, the whole of this "venous" blood is at once sent by a large artery (Pulmonary) to the lungs. You recollect that this blood is of a purple colour. In the capillaries of the lungs it gives up Carbonic Acid to the air, and suddenly becomes changed in colour from dark purple to bright scarlet. This change of colour is due to its having given up Carbonic Acid and taken in another gas, called Oxygen, which forms part of the air that has been inhaled or inspired. This *Oxygen Gas is absolutely necessary to living beings*. Breathing, then, produces two results—1st, it supplies Oxygen to the blood; and, 2nd, it removes Carbonic Acid from the blood.

The purified blood is now returned to the heart in order that it may distribute it all over the body. You can now see the great advantage that results from the heart being double; for the pure blood is returned to the *left* chamber,

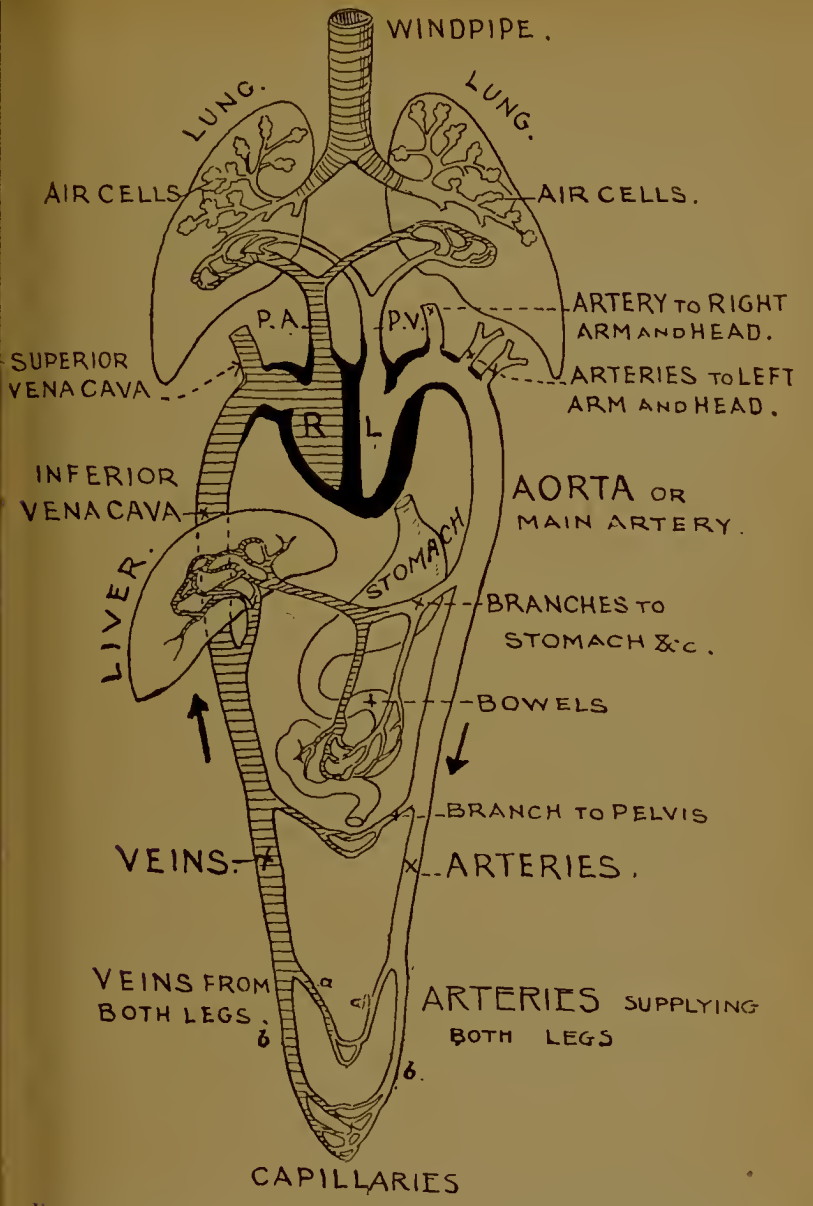


FIG. 9.—R. is placed in the right chamber of the heart. L. is placed in the left chamber of the heart. P.A. Pulmonary artery taking blood to lungs. P.V. Pulmonary vein returning blood from lungs. The arrows show the direction in which the blood flows.

so that it is kept quite separate from the dark purple blood in the right chamber of the heart. The passage through the Lungs completes the Circulation of the Blood. And now all you need to know further is something about the *Action of the Heart*. You have learnt that the blood is always moving onwards in the blood-vessels. It is the heart that drives it along. Immediately the heart is filled with blood it suddenly contracts so as to squeeze out all the blood within it and force it into the arteries. The instant this has occurred, a valve situated at the junction of the heart with the artery closes across the tube and thus prevents the blood flowing backwards to the heart; then, after a moment's rest, it again expands to allow blood to enter from the veins. The arteries are very elastic, and they are considerably expanded or distended by the rush of blood from the heart. This elasticity allows them to recover and regain their former size, in doing which they force the blood further onwards during the time that elapses from the end of one contraction or "beat" of the heart to the beginning of the next.

The course of the blood is constantly maintained in *one* direction, namely, from the veins through the heart into the arteries, and is not allowed to move in the opposite direction. The order is—veins, heart, arteries, capillaries, veins, heart, and so on.

The expansion of the arteries due to the sudden inrush of blood from the Heart can be felt, and is called *the Pulse*. The heart beats or expels the blood about seventy times in a minute, so that *the blood travels along the arteries in jerks*, though by the time it reaches the capillaries it moves in a steady stream and continues to move in a steady stream in the veins. This is very important to remember with regard to bleeding.

I have told you that the blood is a liquid, but you are probably aware that when it escapes from a wounded blood-vessel it *clots*; that is, it becomes more or less solid.

To resume, then, the course of the Circulation is as

follows. The venous blood enters the right side of the heart, from this it goes to the lungs, and is then returned to the left side. The left side forces it along the arteries to the capillaries of the whole body (except the lungs, of course), from whence it returns by the veins to the right side again.

The circulation of the blood may be interfered with in various ways. *Partial obstruction* for any length of time will cause Dropsy of the part of the body beyond the obstruction—that is, further away from the heart. *Complete obstruction* of a large artery will often result in Gangrene (Mortification) of the part of the body supplied by it. A blood-vessel may be *cut* or torn across, or when diseased may burst, without any external injury. The blood will then escape from the vessel, constituting

HÆMORRHAGE, OR BLEEDING.

Bleeding from the surface of the body is called "external hæmorrhage"; that more deeply seated, as from the lungs, "internal hæmorrhage." If the internal hæmorrhage is from the stomach, the blood may be vomited; if from the lungs, it is coughed or spit up. This is known as "hæmoptysis"; if from the nose, "epistaxis," if into the brain, "apoplexy." In a bruise—such as a black eye—there is bleeding under the skin.

The Treatment of Hæmorrhage depends upon the kind of blood-vessel that is wounded. You must find out whether it is an artery, capillaries, or vein. To do so you must notice two things: First, the colour of the blood; and, second, the manner of its escape.

As *the blood* moves more or less in jerks in an artery, it *spurts out in jerks* in *arterial bleeding*, and is of a bright *scarlet colour*. Sometimes it will spurt out to a considerable distance on to surrounding objects. You will, of course, understand that the jerks will not be *seen* unless the wounded

artery is near the surface of the wound, and the opening in the artery not covered up by any structure. The blood may escape from the *wound* in a continuous stream in arterial bleeding, though from the artery itself it comes in jerks.

In *capillary bleeding* the blood is bright red, and comes from the whole surface of the wound in a gentle continuous flow.

In *venous bleeding* the blood is *dark purple*, and flows in a *continuous stream*, which will be very profuse if the vein be a large one. You know that the blood is being forcibly pushed on by the pressure of the heart's contraction, and can understand that the force becomes less and less the further the blood gets from the heart. You will also see that the greater the pressure on the blood the more rapidly it will escape from a wounded vessel. From this it follows that the larger the artery and the nearer it is situated to the heart the more rapid will be the loss of blood, and the more need is there for prompt treatment. In arterial hæmorrhage, therefore, you must arrest its flow as quickly as possible. Where you have hæmorrhage in conjunction with some other injury, the hæmorrhage must receive the *first* attention, as nothing else requires such prompt treatment.

Capillary bleeding is seldom serious.

Venous bleeding is serious in proportion to the size, number, and position of the veins injured, and although, as a rule, venous bleeding is not so serious as arterial bleeding, yet the patient may die in a few minutes from rupture or wound of a large vein, and therefore such an accident must receive the most prompt attention.

Now you have arrived at one of the most important parts of this course of study.

What are you going to do in any given case of bleeding? How does the *natural arrest of hæmorrhage occur?* By the blood at and around the ends of the divided blood-vessel clotting and forming *a plug*, which closes the vessel and becomes firmer and firmer until finally it is quite strong

and secure. So we must adopt some means which will help the clot to form, and also prevent its being disturbed whilst forming.

The three chief means of stopping bleeding are—

I. Elevation of the wounded part.
II. Application of cold.
III. Pressure—
 (*a*) of finger on the wound, or on the main artery.
 (*b*) of pad and bandage on the wound, or on one or both sides of it.
 (*c*) of tourniquet on main artery.

I. *Elevation of the wounded part.*—Suppose a vein in the leg is wounded or has burst. The *first* thing to do is to make the patient lie flat on his back, and then raise up the bleeding leg. This alone will often be sufficient to stop venous bleeding.

In Epistaxis (bleeding from the nose) the head should be raised.

II. *Cold*, applied by means of wet cloths, will generally stop *capillary bleeding*, but must not be relied upon for arterial or venous bleeding. Ice is given for bleeding from the stomach or lungs.

III. **Pressure** is the surest means to employ, and the most generally useful of all instruments is *the finger;* for firm pressure with the finger can arrest bleeding from any part of the surface of the body if the wound be not too large.

In severe bleeding *first of all place the tip of the first finger or thumb exactly on the bleeding point*, that is, on the wound, and if this does not stop the bleeding, press the main artery going to the part. If the wound be small, or only in one large vessel, and there be a hard surface (bone) just beneath against which you can press the blood-vessel, the pressure of the finger will stop the bleeding *immediately*, because the blood-vessels are only soft india-rubber-like tubes which can be flattened by pressure. Generally the finger-tip will

easily stop bleeding about the head where you can feel bone just below the skin. In a fleshy part, such as the middle of the thigh, the finger-tip will not suffice. In this case you must immediately apply pressure at that point, nearer

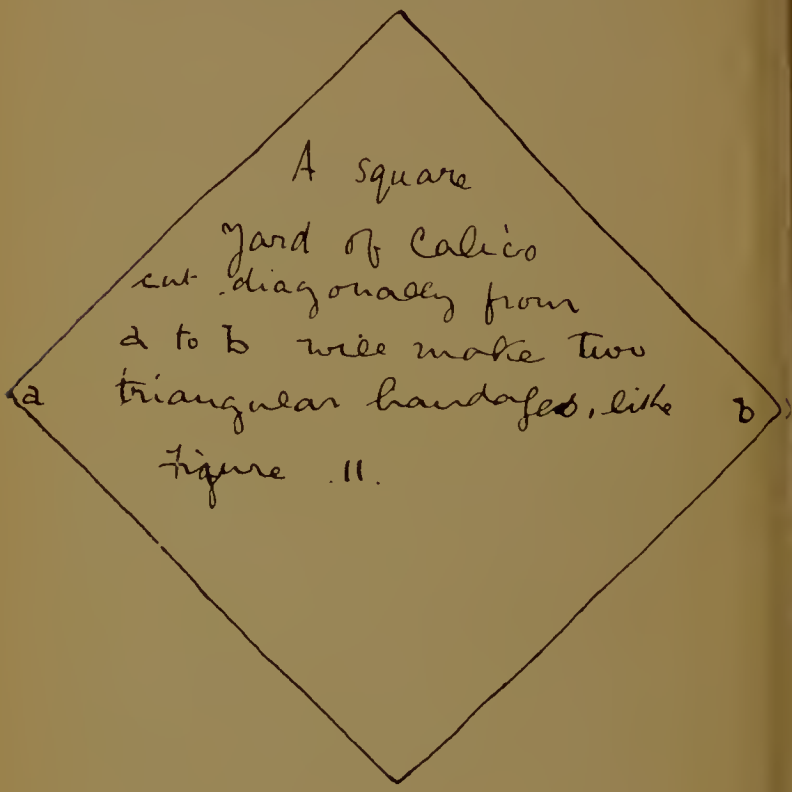


FIG. 10.

the heart, where the artery is known to lie near the surface, and to have bone just beneath it—that is, in *the Groin.*

Pressure with the finger cannot be maintained long, so you will have to resort to the next means, viz., *pad and*

bandage. A pad is made of some smooth but hard substance, such as a pebble, cork, folded cardboard, &c., wrapped up in a piece of clean linen, lint, or calico (Fig. 26). Its size will depend upon the part affected, but generally the complete pad should be about the size of a five-shilling piece. This, as a rule, is placed *on the wound*, but *sometimes* on the vessel *some distance from the wound* (Fig. 26—For wound of foot), and then fixed securely by a bandage passed round the part, with just the



FIG. 11.—Esmarch's triangular bandage. (This is a copy of the bandage issued by the St. John Ambulance Association.)

necessary amount of pressure to arrest the bleeding. The bandage that is of most general use is what is known as the *triangular bandage*, consisting of a piece of thin calico, not too stiff, made by cutting a square yard diagonally along the dotted line, as in Fig. 10.

One square yard makes two bandages like Fig. 11.

You must at once make yourself familiar with this bandage, and the names of the various parts of it as shown in the diagram.

Fold the "point" to the "centre," then fold again until about three inches broad. This is now ready for

tying round any part of the limb or the head to secure the pad placed over a wound.



FIG. 12.—Bandage ready for application as a tourniquet.

You should now commence Part II. of this manual, and study it along with Part I.

The tourniquet is made by folding the triangular bandage very narrow, until it resembles a soft thick cord, and then tying a firm knot (or even two knots) in the middle (Fig. 12).

The tourniquet is applied in two situations only, namely, round the *thigh* and round the *upper arm*. In these situations, especially in the thigh, the artery is a long way below the surface of the skin, and is surrounded by soft tissues. Consequently, firm pressure is required to close the vessel. The pressure would need to be very great round the thigh if the bandage were merely folded, but the knot, if applied exactly over the artery, makes it unnecessary to use quite so much pressure. Hence you see how important it is to learn the exact position of the main arteries of the limbs.

The knot of the tourniquet *must be placed exactly over the artery ;* the ends are then passed round the limb and firmly tied together (see Fig. 13).

In a muscular thigh even this would not exert sufficient pressure, and it would be necessary to tighten it still further. This can be done by pushing a small rod, such as a thick pencil, **between the two halves of the knot** in the ends of the bandage and twisting it. Watch the bleeding, for the moment this ceases you must stop twisting the tourniquet. It is often well to place a piece of stiff paper under the bandage, next the skin, to prevent the skin being pinched up. If no stick is at hand you may tighten the

bandage by twisting the knot with the fingers. If there is any one at hand to help, let him now hold the bandage whilst you dress the wound. The stick must not be passed between the bandage and the skin.

Caution.—The tourniquet stops the circulation of the



FIG. 13.—Tourniquet applied to the brachial artery. The stick is placed in the knot ready to tighten the bandage.

blood in all parts beyond it, so that it cannot be left on an indefinite time. As soon as you have dressed the wound slacken the tourniquet. If you see that there is now no more bleeding, remove the tourniquet; but if there is still bleeding to any important extent you must re-apply it. If there is no one to help, you must fix the stick either by the same or an extra bandage.

Pupils generally have a difficulty in fixing the stick so as to prevent it untwisting. But it can easily be done with the ends

of the *same* bandage in the case of the arm (Fig. 13); the thigh, however, in the adult, will require an extra bandage.

There is one condition in which the tourniquet should be applied although there is little or no bleeding, namely, where the injury to the soft parts is so deep and extensive that you know that large vessels must have been divided, although there is little blood escaping from the wound. The slight amount of bleeding in such cases is due to the very feeble action of the heart owing to the shock from the injury. You must not rouse the patient up before you apply the tourniquet or you will excite the heart and bring on violent bleeding. If you leave the patient quiet the clotting of the blood will soon close up many of the injured blood-vessels.



FIG. 14.—The tourniquet bas been tightened, and the stick is secured by the free ends of the bandage.

POSITION OF THE MAIN ARTERIES, AND WHERE TO APPLY PRESSURE TO THEM.

Arteries of the Head and Neck.—The two main arteries, called *Carotid*, which convey blood to the head, lie deeply in the neck, in close contact with the front of the

spine, one on the right the other on the left of the windpipe. If the upper part of the windpipe be grasped gently with the finger and thumb, and the tips pressed backward, the pulsation of both vessels may be easily felt. This is

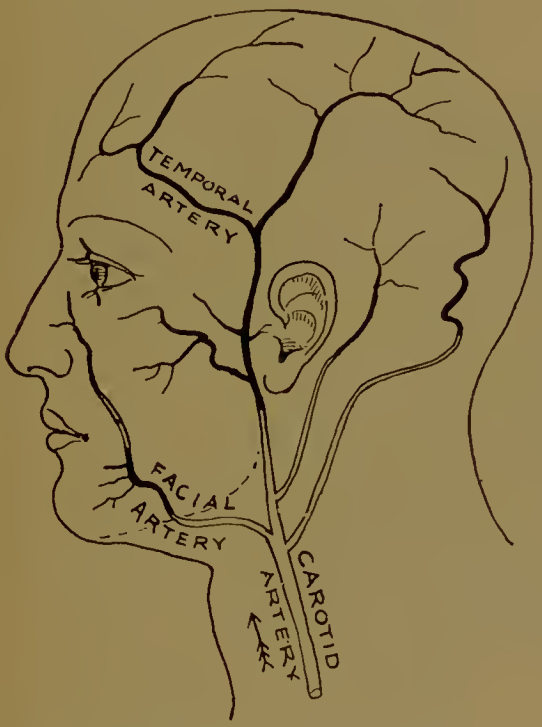


FIG. 15.—Arteries of the head. The black portions are near the surface and easily compressible. The light portions are placed deeper.

the place to apply pressure, and it must be done by pressing the fingers in a backward direction toward the spine, or the thumb may be employed (see Fig. 16).

There is a very large vein, called *Jugular vein*, returning

blood from the head and running down the neck by the side of the carotid artery. A deep wound in the neck might divide either the artery or vein, or both. In applying pressure for a wound of these vessels with the fingers, place the middle one on the wound, the first above and the third below the wound, the more certainly to prevent the escape of blood, for blood may escape rapidly from the *upper* end of a divided carotid artery, because this artery communicates freely by means of very large branches with the corresponding vessel on the other side of the neck. Pressure must be maintained by the fingers alone until the arrival of a surgeon.



FIG. 16.—Compression of right carotid artery.

Facial artery.—This artery can be felt beating against the under edge of the lower jaw, about an inch in front of the angle of the bone (near the *x* in Fig. 1). It is easily compressed in this situation by means of the pad and bandage.

Temporal artery.—This artery can be felt beating just in front of the upper part of the ear, and can be followed across the temple towards the forehead. In old people its pulsation is *visible*. There is an artery just behind the ear, and another, rather larger, further back, one inch from the middle line of the neck. Each of these arteries can be compressed by placing a small, hard, smooth pad over it. *Place the pad on the*

wound and the *middle of the bandage* on the pad. Then



FIG. 17.—Bandage applied to compress temporal artery (or for wound of front or back of the head). A small pad is first placed on the wound.



FIG. 18.—Same as Fig. 17, seen from right side.

carry the ends of the bandage round the head, cross them

just in front of one ear and pass one end over the head, the other under the chin, and tie immediately in front of the opposite ear. (Fig. 17.)

With the bandage arranged in this manner bleeding may be arrested from any part of the head. By beginning with the *middle of the bandage on the pad* you need no assistance, for you can take up the bandage with one hand whilst you hold the pad with the other. The bandage may, if necessary, be secured with a pin, or needle and thread, where the ends cross at the knot.



Fig. 19.—Compression of the subclavian artery.

Subclavian artery is the commencement of the vessel carrying blood to the arm. It is placed deep in the neck, behind and below the collar-bone. If wounded itself, or if the artery in the arm be wounded near the armpit, too high up to use a tourniquet, you must press the *thumb* deeply into the root of the neck, immediately behind the middle of the collar-bone, and direct the pressure downwards and backwards. Firm

pressure will be needed, and a good plan is to cover the round end of a door-key with a cloth and press it on the vessel, and keep it there until the arrival of the surgeon. (Fig. 19.)

Arteries of the Arm.—Brachial artery.—This,



IG. 20.—Main artery of right arm seen from the front. The upper part can easily be compressed by the thumb or fingers.

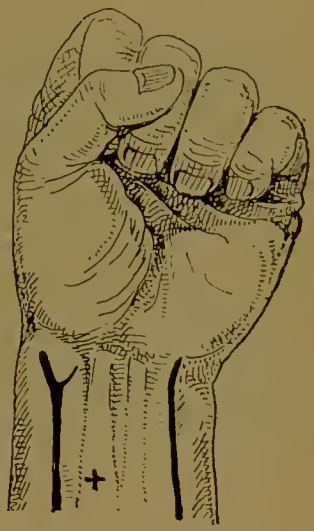


FIG. 21.—Arteries at the wrist. The hand is bent at the wrist so as to make the tendon *x* prominent. The black lines show the exact position of the two largest arteries. They can be easily compressed.

the continuation of the Subclavian artery, passes from the middle of the armpit down the inner side of the arm, just under cover of the inner edge of the Biceps muscle. (This muscle can be felt to rise up in front of the arm when you

forcibly bend the elbow.) The biceps can be felt to terminate in a strong, round, and prominent sinew at the bend of the elbow. At the elbow the artery lies close to this sinew. The entire course of the artery follows the direction of the inner seam of the coat sleeve, being quite on the inner side high up, and getting further forward as it approaches the elbow, at which point it is in front. Thus you see it is, like all other main arteries, in the situation which protects it as far as possible from external injury. For instance, if the brachial artery coursed over the back of the elbow instead of in front of it, it would



FIG. 22.—Compression of both arteries at the wrist.

be much more liable to injury, and so with all other arteries of the body. Pressure may be applied to the brachial artery at any part of its course, either by the fingers or the tourniquet.

At the elbow the artery divides into two branches, corresponding to the bones of the forearm. They pass one in front of each bone down to the wrist, where they are about an inch and a half apart. Clench the hand tightly and bend it forward towards the front of the forearm, and you will see a sinew rise into prominence, a little to the outer side of the central line of the wrist. Just outside

this is a groove in which you can feel the pulsation of the outer—the radial—artery. The inner of the two vessels is half an inch from the inner edge of the wrist (Figs. 20, 21).

Both these vessels can be easily compressed against the bone in this situation by the thumbs (Fig. 22), and by placing a small pad over each, and securing them with a bandage passing two or three times round the wrist (Fig. 31). *The artery at the bend of the elbow* can be compressed by placing a soft pad in the elbow, and then flexing the arm—drawing the fore-arm near the upper arm, and fixing with a bandage in the manner shown in Fig. 23.

The patient can himself compress the artery at the elbow by gathering up the sleeve of the coat as a pad, and then bending the arm forcibly by pressing with the other hand at the back of the wrist.

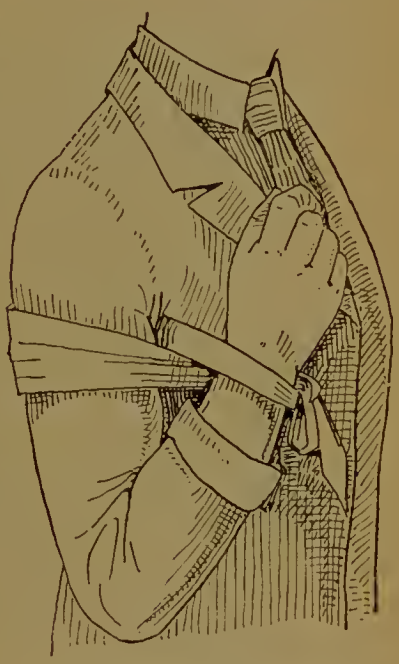


FIG. 23.—Compression of main artery at elbow. A small pad is pressed in the bend of the elbow.

Digital pressure (*i.e.* with the fingers) on the Brachial is either applied by grasping the arm from behind, the *right* hand grasping the *left* arm of the patient, so that the finger-tips press on the main artery, or (if the patient be lying down) you may grasp the biceps muscle from the front, pressing the tips of the fingers on the artery.

This way is perhaps better than using the thumb (Fig. 26)

for the purpose, because at least *one* of the fingers is likely to be on the right spot. You should *practise this* whilst feeling the pulse at the wrist with the left hand, and you will find how slight a pressure will stop the circulation, when accurately applied; a pressure which need not be at all uncomfortable to the patient. If you need to press hard enough to *hurt* the patient, you may be sure you are *not* pressing quite on the right spot. The patient can stop his own pulse by pressing the thumb on the Brachial, and this,



FIG. 24.—Compression of brachial artery from behind.



FIG. 25.—Compression of brachial artery from the front.

of course, would arrest hæmorrhage from a wound in the hand or forearm. The two arteries at the *wrist* can be compressed by placing a thumb on each.

Femoral artery.—This is the main artery of the leg, and enters it at the fold of the groin (Fig. 27), a very short distance to the inner side of the middle line of the thigh in front. It passes as though it were going to the inner side of the knee, but half-way down it goes through the muscles, and thus gains the back of the knee. Here it cannot be felt, but at the groin the pulsation is easily dis-

covered. *The tourniquet* can be applied to the thigh. Care must be taken to place the knot exactly over the artery (Fig. 28). If wounded too high up for the application of a tourniquet, pressure must be applied by the thumb on the vessel in the groin; and in any case requiring digital



Fig. 26.—Compression of brachial artery by the thumb.

compression of the Femoral artery it is best to apply pressure in the groin just where it crosses over the edge of the pelvis. Below the knee the artery divides into two branches, like the brachial. They come near the skin at the ankle, one being situated exactly in the middle line *in front*, and the other in the deep groove *behind the inner ankle bone*. In these two situations pads can be fixed to

arrest severe bleeding from the foot (Fig. 29), although a pad must also be applied on the wound itself. The lower limb can be treated with a bandage and pad at the back of the knee, with the leg bent under the thigh, for severe bleeding below the knee, in the same way as the elbow is bandaged (Fig. 30).



FIG. 27.—Front of thigh and leg, showing main artery. The black portions lie near the surface in front; the dotted part is *behind* the knee.

Venous Bleeding.—In all cases where this is severe a *pad* must be placed *on the wound*, and it should be large enough to exert *pressure* on the vein or veins *on both sides of the wound.* Look at the veins of the arm or leg (Figs. 31 and 32), and you will see how they communicate with one another, so that in such a situation as this *the blood might flow backwards* towards a wound. This backward flow of blood is more especially liable to occur from a wound in the leg, below the knee, where the veins are often much enlarged, forming what is known as "*varicose veins.*" There are *valves* in veins which in the healthy condition prevent the blood flowing backwards. When they are varicose the veins are so much distended or enlarged that the valves do not reach across the vessels, and so the blood can flow backwards, away from the heart, should the vein burst or be accidentally divided. So you see it

is necessary to arrange one or more pads in such a way



FIG. 28.—Tourniquet applied to main artery of left leg.

that the blood cannot get to the wound from the vein beyond, nor flow to it in a backward direction.

In Fig. 33 the arrow indicates the direction in which the blood is flowing in a group of veins. If one be wounded at B, and pressure is applied only at P, the blood could flow backwards to the wound from the point C. Hence *in venous bleeding*



FIG. 29.—Compression of both arteries at ankle (left leg).

pressure must be applied to the vein on both sides of the wound.

If *blood* is issuing *from a large vein in the leg*, the *first* thing to do, before attempting to apply any pad or bandage to the wound, is to *make the patient lie down* and to elevate



FIG. 30.—Compression of the main artery behind the knee.

the limb. Then proceed to dress the wound, at the same time removing all constricting bands, such as garters.

We must now consider Hæmorrhage in relation to

Wounds: their kinds and situation.

Wounds differ considerably according to the agents producing them.

(1.) *An Incised wound* is a clean cut, such as would be made by the sharp edge of an ordinary knife. The blood-

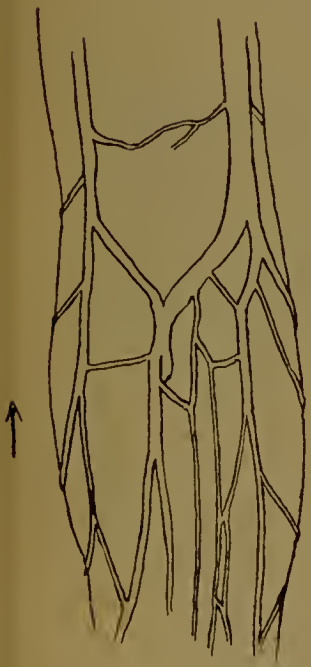


FIG. 31.—Veins in front of forearm and elbow, showing how they communicate with one another.



FIG. 32.—Veins of the leg and foot.

vessels are cut clean, so that they bleed more freely than in any other kind of wound.

(2.) *A Punctured wound* is produced by the thrust of a pointed instrument, such as a bayonet. It is a dangerous wound, for it may puncture a deeply-seated vessel; and though little blood may escape externally through the wound in the skin, there may be very serious internal hæmorrhage.

(3.) *A Contused wound* is produced by a blunt instrument, and very often by falling on a hard surface. The parts are bruised. The bleeding, as a rule, is not so serious as in incised wounds.



FIG. 33.

(4.) *A Lacerated wound* is produced by something that tears the part. The bleeding is sometimes not serious, even in very extensive lacerations.

Treatment of wounds.

1. Arrest the bleeding.
2. Close the wound.

If the hæmorrhage is serious the *first* thing to do is to stop it. If it is not very abundant and the wound is dirty, it should be cleansed. This is best done by washing well with water (preferably some that has been boiled). Never use an ordinary sponge for the purpose, but use lint, cotton wool, or a piece of perfectly clean linen. The means employed for stopping the bleeding must be used according to the rules already given. In all cases *place a firm pad on the wound*, that is, exactly on the bleeding spot, and hold it there or fix by a bandage.

The following is a list of wounds in various parts of the body, and the means to be employed in each case of arterial bleeding are given in the order in which they should be used—that is, first use No. 1; if not found sufficient, try No. 2; then if necessary No. 3, and so on. For instance, *in a wound of the hand* it would not be right to stop the

circulation through the whole length of the arm, by using the tourniquet, if direct pressure on or near the wound would suffice. Therefore, proceed as follows :—

1. Digital pressure on wound ; then
2. Pad and bandage. If not sufficient apply
3. Pad and bandage at wrist, on both arteries (Figs. 21 and 34).

This may still not be effectual, in which case adopt

4. Pad in elbow as described previously (Fig. 23).

If these means still are ineffectual, apply

5. Tourniquet round upper arm. This will seldom be required for a wound of the hand (Fig. 13).



FIG. 34.—Application of bandage to secure pads at wrist.

Wounds of the

Head or Cheek.—1. Digital pressure on wound ; then
2. Pad on wound and bandage round the head (Fig. 17).

Chin.—1. Digital pressure on wound ; then
2. Pad on wound and four-tailed bandage (Fig. 36).

Neck.—Digital pressure on wound or on main artery.

A bandage must not be made to encircle the neck, but if the wound be high up the bandage may go round the head, and if the wound be low down it may be taken under the opposite arm.

In case of *severe arterial bleeding in the arm or leg* it will be necessary to *apply digital pressure to the main artery first*, then the tourniquet, in order to arrest the bleeding immediately, and so allow time to apply suitable dressing to the wound.

Armpit.—Digital pressure on subclavian (Fig. 19) and a thick pointed pad on the wound, secured by a bandage tied over the same shoulder and then fastened under the opposite arm.

Upper arm.—1. Digital pressure on wound.
2. Pad on wound and bandage.
3. Tourniquet above wound (Fig. 13).

Forearm.—1. Digital pressure.
2. Pad on wound and bandage (Fig. 34).
3. Pad and bandage at bend of elbow (Fig. 23).
4. Tourniquet to upper arm (Fig. 13).

Hand.—1. Digital pressure on wound.
2. Pad on wound and bandage.
3. Pads and bandage at wrist.
4. Pad in elbow.
5. Tourniquet to upper arm.

Thigh—In the groin.—1. Digital pressure on wound by means of the thumb.
2. Pad on wound and bandages round hips and thigh.

Below the groin.—1. Digital pressure on wound.
2. Digital pressure at groin.
3. Pad on wound and bandage.
4. Tourniquet (Fig. 28).

Behind knee.—1. Pad on wound and bandage.
2. Tourniquet to thigh.

Leg.—1. Digital pressure on wound.
2. Pad on wound and bandage.
3. Pad and bandage at bend of knee (Fig. 30).
4. Tourniquet to the thigh.

Foot.—1. Digital pressure on wound.
2. Pad on wound and bandage.
3. Pad and bandage at ankle—one in front and one behind the inner ankle (Fig. 29).
4. Pad behind the knee.
5. Tourniquet to the thigh.

Closure of the wound.—A wound from which the bleeding can be stopped without the application of firm pressure should be cleansed by pouring upon it a stream of water, and the edges should be brought together as accurately as possible, and maintained so by pads and bandage until the arrival of the surgeon. Here I must *caution* you against the temptation to undertake the *entire treatment* of a wound. *All wounds should be under the charge of a surgeon*, and an attempt on your part to take the place of a doctor may produce disastrous consequences. Small wounds of the face particularly require skilled treatment from the first, to prevent the disfigurement which might otherwise result.

Epistaxis, or *bleeding from the nose.*—Keep the head erect, apply cold to the nape of the neck, raise the arms above the head, and put the feet in water as warm as can be borne.

Vomiting or *spitting of blood.*—Keep the patient very quiet and lying down, and give ice or iced water.

FRACTURES OR BROKEN BONES.

There are various kinds of fracture.

1. If the bone alone is broken it is called a *simple fracture.* In children the bone is tough, and will sometimes bend, and break only half through at the bend, like a green stick. This is called a *green stick fracture.*

2. When there is a wound in the skin communicating with the seat of fracture, it is called a *compound fracture.* This is much more dangerous than the simple fracture, because, first, there may be much loss of blood; secondly, blood-poisoning may arise and cause the death of the patient.

3. There may be a large blood-vessel wounded, or some important organ, such as the brain, lung, or liver injured. It is then spoken of as a *complicated fracture.*

4. A bone may be broken in more places than one; this is called *comminuted.*

How are you to know when a bone is broken? By observing what are called the *signs of fracture.* These signs are best remembered by taking them in a definite order, such as that given below. Be particular *in all cases of doubt* to *compare the injured with the sound side* of the body.

Ordinary signs of simple fracture.

A. The patient complains of
 1. Pain at the seat of fracture.
 2. Loss of power or inability to move the part.

B. You may *see*
 3. Deformity (bending or shortening).

C. You may *feel*
 4. Irregularity.
 5. Abnormal movement.
 6. Crepitus.

These are the signs you must look for, though they are not necessarily all present in any particular case. In certain fractures there may be *other symptoms* as well, owing to some complication; for instance, fracture of the skull may be attended by *unconsciousness*, and, of course, in compound fracture there will be *external bleeding.*

Loss of power.—If the arm or thigh be broken the patient cannot lift the limb.

Deformity means some alteration in shape due to the injury. In some fractures the deformity is very slight, and may in rare cases be entirely absent.

Irregularity.—To feel this, draw the tip of one or more fingers slowly along the bone, and at the seat of fracture you will feel some ridge, projection, or depression; and *gentle* pressure at this point will cause the patient pain.

Abnormal movement.—When an arm or leg is injured,

and you are doubtful about the existence of fracture, grasp the limb firmly with both hands, one above and the other below the place of injury. Fix the limb with the higher hand, and move it gently from side to side with the other hand. You will find, in the arm and thigh, and in the forearm and leg also if both bones are broken, that there is a certain amount of *movement* as though there were a joint *at the seat of fracture*—at (*a*), for instance, in Fig. 35.

Crepitus.—Whilst moving the two portions of the broken bone or bones on one another, you will often feel a peculiar grating sensation. This, when present, is a most valuable



FIG. 35.—The leg B is broken at *a*.

sign, and is called *Crepitus*. If you will break a mutton-bone in two, put the two pieces together again, and gently move one piece sideways without letting them separate, you will feel this creaking or crepitus, but much more distinctly, of course, than in the human body, because there the soft tissues surround the broken ends. Crepitus is a most valuable sign, because it may be the only sign you can find. For instance, in fracture of the thigh-bone high up there may be no displacement or deformity visible, and no irregularity or abnormal movement felt; but if you can feel crepitus, and the patient has pain with loss of power in the

limb, you will know that there is a fracture. Sometimes crepitus is best felt by GENTLY *pulling* at the limb. The pulling will also help to restore the limb to its proper shape. Keep it there to prevent further deformity until the splints are ready.

Now study Fig. 35 B in connection with the table of signs. Here the bone is broken at *a*. Signs No. 1 and 2 will be present, 3 is clearly present, 4 will be felt, and as both bones are broken, you will feel 5 and probably 6. Refer also to Figs. 35 and 43.



FIG. 36.—Four-tailed bandage applied for injury to lower jaw.

Special signs in each fracture will be best considered in connection with the treatment.

Treatment of Fractures.—Bring the portions of the broken bones as nearly as possible into their natural position by drawing *steadily* on the lower portion of the limb. This must be done with the greatest care, for rough handling of a simple fracture may easily convert it into a compound or complicated one. Keep the parts at rest by means of splints or other retaining apparatus. In any case where deformity is absent or only very slight, splints should be applied immediately, without handling the limb more than necessary.

Splints.—Smooth flat pieces of wood, stiff cardboard, folded newspaper, a bundle of straw, a stocking filled with sawdust, bran or rags, a bundle of twigs tied together, walking-sticks, umbrellas, guns, swords, bayonets, &c., may be used as splints in cases of emergency. Hard splints should be padded with wool or soft cloths when placed next the skin, as shown in Fig. 41. The splints must be

secured to the limb by one or more triangular bandages, each bandage going round the limb as often as it will reach. *In the lower limb* it is well to fasten the bandages so that they may be undone *without disturbing the limb*. Thus—fold the bandage narrow, then double it in two lengthways, place it thus doubled under the limb (see Fig. 44), then place one end through the loop as at *b* and tie the two ends together as at *c*.

Splints should be applied *outside the clothing* in First Aid, except sometimes in compound fractures, where the wound must be exposed and dressed before the fracture is attended to. *Splints*, for all fractures, *should project beyond the joint at both ends of the broken bone*. For instance, in fracture of the leg let the splints be long enough to reach above the knee and below the ankle.

In the following cases it must be understood that the ordinary signs of fracture are present, unless otherwise stated, in *addition* to the special signs mentioned.

Fracture of the top or side of the head is caused by a blow or fall on the head. The patient is often unconscious, and the injury is generally compound.

Treatment.—Do not apply *any* pressure to the seat of fracture. Keep the patient very quiet, and send for a surgeon immediately.

Fracture of the base of the skull results from falling on the top of the head.

The ordinary signs of fracture are absent, but as a rule there is bleeding from the ear, nose, or mouth, together with more or less unconsciousness.

Treatment.—Do not attempt to do anything beyond keeping the patient quiet until the surgeon arrives.



FIG. 37.—Four-tailed bandage.

Fracture of the lower jaw.—Besides the ordinary signs there will be bleeding from the lower gums.

Treatment.—Bandage as in Fig. 36 with four-tailed bandage (Fig. 37), made by cutting a strip 4 feet long from both ends almost to the middle.

Fracture of the collar-bone (clavicle) (Fig. 38).—Special signs are: The shoulder falls downwards, forwards,

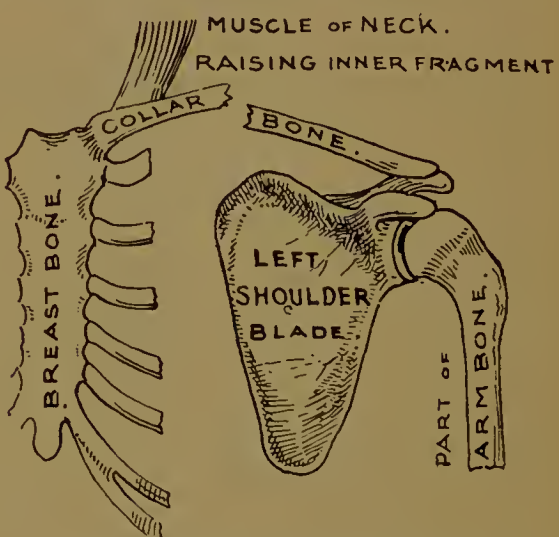


FIG. 38.—Fracture of collar-bone, showing dropping of shoulder (compare with Fig. 6).

and inwards; patient supports his elbow with the other hand, and the head leans towards the injured side. Observing these conditions, look next for ordinary signs.

Treatment.—First method: Whilst preparing the bandages lay the patient flat on his back, with a pillow between the shoulders. Put on the large arm sling to *raise the shoulder*, a thick pad in the armpit, and a narrow bandage round the waist and crossing the arm and sling close to the

elbow. This will *draw the elbow to the side*, and at the same time draw the point of the shoulder a little *outwards*.



FIG. 39.—Bandages applied for fracture of left collar-bone.

Second method (Fig. 39): If the bone seems nearly perforating the skin draw both shoulders back with two

bandages passing round the shoulders and tied together behind. Then apply the larger arm sling. Sometimes it is more comfortable to the patient to have the front fold of the sling taken *under* the shoulder.



FIG. 40.—Splints, &c., applied for fracture of humerus (upper arm).

Fracture of the upper arm (Humerus). — Signs ordinary.

Treatment.—Apply three splints; one on the outside from the tip of the shoulder to the point of the elbow, one on the inner side from the armpit to the elbow, and one behind. Notice in Fig. 40 there is no splint in front of

the arm. Secure the splints by two narrow bandages. The arm must now be placed in the *small arm sling*. The



FIG. 41.—Splints applied for fracture of forearm. The arm must be placed thus across the chest before being secured by bandages.

large sling if drawn up tight would press the broken ends past one another by drawing up the elbow. It will be advisable to remove the coat before applying splints.

The proper way to remove a coat, in case of injury, is to take the sleeve off the sound arm first. Then the sleeve on the injured side is easily and painlessly removed by gently pulling the cuff whilst the arm is hanging straight down. If there be any difficulty the sleeve should be cut along the seam.

Fracture of the forearm or wrist. Ordinary signs.

Treatment (Fig. 41).—Place one splint along the front of the arm as far as the palm of the hand, and the other on the back of the arm. The fore-arm must be brought across the breast *before* securing the splints, otherwise the end of the inner splint might press uncomfortably against the upper arm when the elbow is bent. Put on the large arm sling.



FIG. 42.—Two broad bandages applied for fracture of ribs on the right side.

Fracture of the bones of the palm.—Signs ordinary.

Treatment.—Place a splint at the back and another along the palm, and secure with bandages. Use large arm sling.

Fracture of the fingers.—Signs ordinary.

Treatment.—Apply small splint from wrist to tip of finger. Two fingers may be bandaged together to give extra support.

Fracture of the ribs.—The principal sign, and often the *only* one present, is difficulty and pain in taking a deep breath.

Treatment (Fig. 42).—Fold two bandages to the width of six inches. Apply one round the chest so that its lower border covers the seat of pain, and the second one lower down, so that its upper border overlaps the first by two inches. The "centre" of each should be over the seat of injury and the ends tied at the opposite side of the chest.

Fracture of the Pelvis, produced by a severe crush. It is a very serious injury.

Treatment.—Keep the patient perfectly quiet until the surgeon arrives.

Fracture of the thigh-bone (Femur) is always a



Fig. 43.—Splints applied for fracture of thigh-bone. Observe there are *three* splints—two short and one long.

serious accident, and requires *very careful handling*. Signs ordinary, with often a good deal of shortening of the limb, which is best detected by placing the patient quite straight on his back, with the feet together, and observing whether the two knee-caps or heels are exactly opposite one another. The foot turns outwards.

Treatment (Fig. 43).—If doubtful whether there is a fracture or not, treat it for a fracture. Apply two splints coming to the knee, one on the outer, the other on the inner side of the thigh; then a *long splint*, extending from the armpit to a little beyond the heel. Secure this by three or four

bandages; a broad one round the chest (with an extra turn round the splint); a broad one round the hips, a narrow one round the knees, and another at the ankles. The two last bandages must fix the sound limb to the injured one as an extra support.



FIG. 44.—Application of bandages and splint for fracture of knee-cap.

Fracture of the knee-cap (Patella).—Principal sign, depression in front of the knee, due to the bone being broken across the middle, and the muscle of the thigh displacing the upper fragment.

Treatment (Fig. 44).—Raise and straighten the leg. Take a narrow bandage, place the middle just above the knee-cap, cross behind the knee, and bring forward and secure just below the knee-cap in front. The aim is to bring the upper portion of the bone (which will be dis-

placed upwards) down again towards the lower. Secure a splint behind, and raise leg as in Fig. 44.

Fracture of the leg (Fig. 45).—If both bones are broken there is generally great deformity, and a great tendency for the fracture to become compound, even if simple at first. If the outer bone alone is broken there may be very little deformity, and the patient may even be just able to stand on the leg, because the weight of the body is supported by the inner and larger of these two bones. See Fig. 8, and compare with Fig. 45.

Treatment.—Place a strong straight splint, well padded, on each side, reaching from a little above the knee to a little beyond the sole of the foot, and secure as shown in Fig. 46. If the foot fall backwards, as it will do if the fracture be near the ankle, it must be supported by a separate narrow bandage. First place the centre of the bandage under the heel, cross the ends over the instep, cross again under the sole of the foot, bring them round, and tie on the top of the instep. Tie both legs together (after applying the splints) with a couple of bandages. A short piece of thin board or stiff brown paper, or even a newspaper folded, or bundle of straw, will make a good splint for the *arm*. For the *leg*, however, larger and stronger splints are required, though in cases of emergency you must use whatever comes first to hand that is at all suitable. A broom handle makes a good "long splint" for the thigh. In fractures of any part of the leg, if no splints are obtainable, tie the two legs together in several places.

Compound fracture.—The *first attention* must be paid *to the wound*. *If* it is *clean*, apply a thick layer of *dry lint* or cotton wool, and secure by a bandage. If the wound is dirty, cleanse it thoroughly by a stream of tepid water that has been boiled. Apply a tourniquet, if necessary. In all fractures you must endeavour to apply the splints in such a way as not to cause the patient any discomfort.

Remember what would be the effect of stopping the circulation by applying the bandage too tightly. (See page 19.) If swelling or coldness of the limb occurs, or if it becomes bluish, the bandage must be slackened immediately, for it has evidently been too tightly applied.

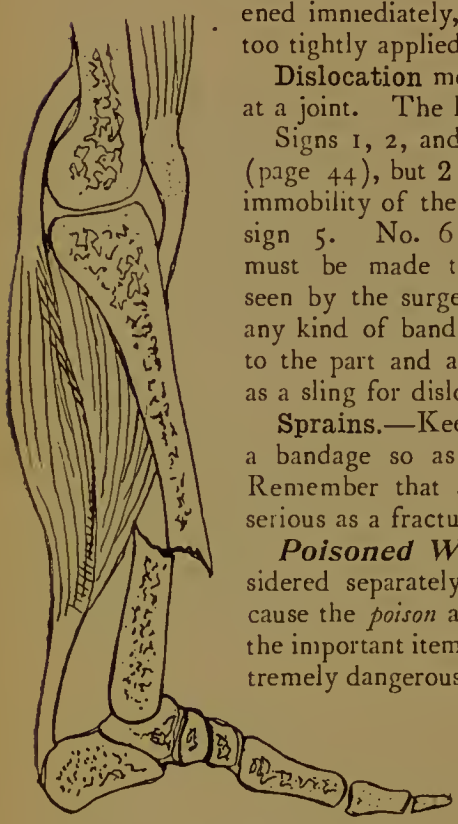


FIG. 45.—Fracture of shin-bone. Compare with Fig. 8.

Dislocation means displacement of bones at a joint. The ligaments are torn.

Signs 1, 2, and 3 of fracture are present (page 44), but 2 shows itself in *rigidity* or immobility of the part, just the contrary of sign 5. No. 6 is absent. No attempt must be made to replace the bone until seen by the surgeon, but you should apply any kind of bandage that will be a support to the part and a relief to the patient, such as a sling for dislocation of the shoulder.

Sprains.—Keep the part quiet, and apply a bandage so as to fix the injured part. Remember that a severe sprain may be as serious as a fracture.

Poisoned Wounds.—These are considered separately from other wounds, because the *poison* and not the hæmorrhage is the important item. They are sometimes extremely dangerous, and require most prompt treatment. You may get a poisoned wound from the sting of an insect, the bite of a rabid animal (mad dog), snake, or the prick of some instrument on which there is some decomposing matter, &c. The hands should be thoroughly washed after dressing any wounds from which there is a mattery discharge.

Treatment.—Prevent the poison getting into the blood stream. Thus, if part of the arm or leg is poisoned, tie a cord round the limb near the wound, but between it and the heart, and suck the wound well, so as to draw out the poison, and let it bleed freely. As soon as possible the wound should be touched with caustic (Nitric Acid), Ammonia, or Acetic Acid. A bite from a dog that is not mad does not need caustic, but must be well washed. The **sting of a bee** can be removed by pressing the open end of the barrel of a watch-key against it. The spot should then be touched with ammonia.

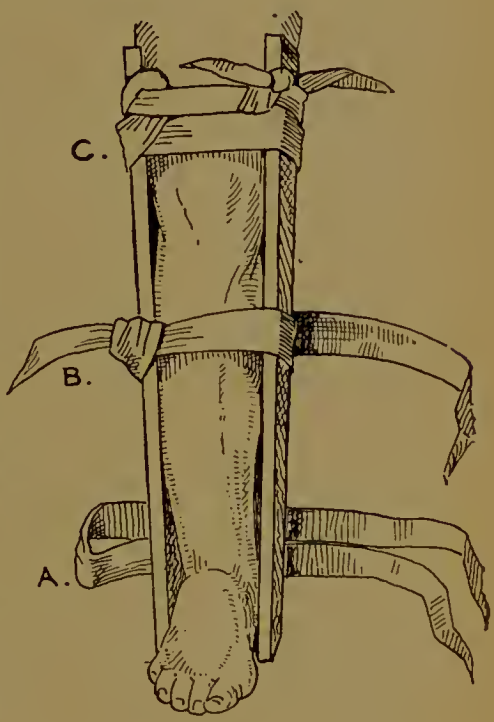


FIG. 46.—Showing one method of securing leg splints. *a.* Bandage doubled. *b.* One end is passed through the loop, then at *c.* Both ends are tied together.

Dust and other foreign bodies in the eye.—Remove by a pointed piece of paper or a camel-hair brush. You will often find it best to stand behind the patient's shoulder instead of in front of him. Afterwards close the eye and place a soft pad over the lid, and retain there by a bandage round the head until all feeling of pain and irritation has passed away.

Lime in the eye.—As quickly as possible wash out with vinegar and water, with the help of a clean rag,

squeezing some drops right on the eyeball, and then place a small pad soaked with vinegar over the closed eye, and secure by a bandage round the head.

Burns and Scalds.—If the clothes are on fire the flames must be extinguished as quickly as possible by throwing some thick cloth (table-cloth, blanket, hearthrug, shawls, coats, or dresses) over the burning parts. If a woman's dress catches fire whilst standing, she should *first of all* lie down (so that the flames may rise upwards away from the body) and call out for help. She might crawl along the floor and ring the bell. If she is standing when you see her, catch hold of her dress collar or her hair from behind, and pull her down backwards without any warning.

After the flames are extinguished, and before removing the clothing, procure some linseed oil, olive oil, or, better still, some *carron oil* (which is a mixture of equal parts of linseed-oil and lime-water), and some lint, cotton wool, or sheet wadding. Then remove the clothing very carefully, *bit by bit*, with a pair of sharp scissors, being careful *not* to disturb any portion of clothing that is sticking to the burnt skin. The whole of the burnt surface is to be covered as quickly as possible with pieces of linen or lint soaked in the oil. If no oil is at hand, cover the part with flour or powdered starch, or vaseline, and then outside this apply the cotton wool, and secure the whole with bandages. The aim is to exclude the air as much as possible and to relieve pain.

This plan of treatment may be used for burns due to powerful chemicals, such as oil of vitriol (sulphuric acid) or nitric acid.

Where the skin is only *reddened*, the intense smarting pain is often best relieved by the application of linen soaked in a strong solution of bicarbonate of soda.

Water may be applied to wash away a strong chemical caustic such as those just named.

Caution.—If the burn or scald be very extensive, the clothing must be removed from only a small portion of the

injured surface at one time, and this portion be dressed with the oil before another portion is exposed and similarly treated. This plan is for the purpose of avoiding the shock to the system which is likely to occur if a large burnt surface is all uncovered at once.

An extensive burn or scald is always accompanied by severe shock to the patient. He gets into a condition of collapse (extreme prostration). It is important to recollect that the danger is in proportion to the extent of the surface injured. For instance, a burn that scarcely blisters the skin of a *large* part of the chest or abdomen is much more dangerous than a greater degree of burning of a *small* extent of surface.

In all cases of burns and scalds medical aid should be procured at once.

Sometimes the *mouth* is scalded with hot water or steam, or is burnt with corrosive acids. Give oil or milk frequently in these cases.

UNCONSCIOUSNESS OR INSENSIBILITY.

Loss of consciousness occurs suddenly from various causes. This subject needs careful study, because the treatment that would be very beneficial in one kind of case might be most injurious in another.

The following table shows **the various conditions in which unconsciousness occurs**, in the order in which you will find it easiest to recollect them in any case you may meet with :—

Fits, of various kinds, such as in

Fainting.
Hysteria.
Epilepsy.
Apoplexy.
Shock, or concussion of the Brain.
Sunstroke.

Poisons—Alcohol.
Opium and other narcotics.
Suffocation or Asphyxia—
From obstruction to Respiration,
(*a*) in the throat (*e.g.* piece of meat);
(*b*) in the lungs—Gas, Water (drowning).

Fainting or Syncopé.—The patient feels light-headed or dizzy, and looks very pale, almost death-like. If standing, he begins to stagger, and then falls down. The breathing is almost imperceptible. The pulse is extremely weak owing to feeble action of the heart. Very often it cannot be felt at all at the wrist. The flow of blood through the brain is consequently greatly diminished, and this in its turn accounts for the loss of consciousness.

Fainting may occur from any condition which interferes with the action of the heart, such as long-standing diseases, severe pain, hunger, fright, hot rooms, and especially loss of blood. It is due sometimes to disease of the heart itself.

In persons predisposed to fainting an attack may come on from trivial causes.

After fainting has lasted for a few minutes, and sometimes even before it occurs, the forehead is seen to be covered with a cold sweat.

To distinguish fainting from other conditions the chief signs to attend to are the extremely weak pulse and the slow breathing.

Recovery is shown by an improvement in the pulse, deeper breathing, and a return to consciousness.

Treatment.—First of all lay the patient *flat* on the floor (if he is not already lying down). This will allow more blood to flow to the brain than in the standing or sitting posture. If at a crowded public meeting you may not be able to do this: here you should let him lean forward so as to bring his head down to the level of his knees for a while, and then, at the earliest possible opportunity, remove

him to the open air. When outside he should be made to lie down if he feels at all light-headed, or has a very feeble pulse, or looks white. The clothing about the neck and chest should be loosened. Do not allow onlookers to press closely around him, for he requires an abundant supply of fresh air. The *face* should be bathed with cold water. He should be made to drink some cold water or a little brandy and water. Half a teaspoonful of solution of *sal volatilé*, well diluted with water, is a good stimulant. The patient generally expresses a wish to get up before he is quite recovered, so it is well to persuade him to keep the head low for some little time after he says he feels all right.

When fainting comes on from loss of blood, and the patient does not revive even after the hæmorrhage has been stopped, it is a good plan to raise both legs well above the level of the rest of the body, in order to help the return of blood towards the heart and brain.

Many cases of fainting are trivial and soon recovered from, but a great number of deaths are directly due to this cause, and often take place with alarming suddenness. It is therefore necessary *in all cases* of fainting that treatment should be promptly adopted.

Hysteria.—Here the patient is not really unconscious (except perhaps in rare cases), though often appears to be so. Frequently she (for it is a disease almost confined to females) is very noisy, shouting, laughing, or crying, and apparently greatly distressed. She is careful not to injure herself, though the friends are often afraid that she will.

Treatment.—Bathe the face with cold water, and get her to drink some. If you are *sure* it is hysteria, it will generally be best to appear to take no notice of the patient. A very common mistake that friends make is to struggle with her; this is almost certain to aggravate the violence of the attack. A **threat** to throw a pailful of cold water over

her if she does not recover in five minutes will generally render further treatment unnecessary, especially if the pail be shown ready for use.

Epilepsy or falling sickness.—This is the name of the disease present in those people who are said to "take fits." These fits come on at uncertain intervals; there may be several in a day, one each day, or months may elapse between the attacks.

The patient is generally young, and, apart from these attacks, may enjoy good health. In many cases the mental powers become gradually impaired.

An epileptic fit occurs *suddenly*, often without a moment's warning, at any time, and in any situation. The patient instantly loses consciousness, and is *violently* convulsed. In the early part of the attack the limbs and features are *rigid*, and the respiratory movements of the chest come to a standstill owing to spasm of the muscles. As a consequence the patient becomes *blue* in the face. Then the muscles (the limbs) begin to jerk violently, and the patient froths at the mouth; and owing to the movements of the lower jaw and tongue, the latter may be bitten, so that blood may be seen coming from the mouth. The movements become gradually less and less until they cease, and consciousness slowly returns. The whole attack only lasts for a minute or two, and sometimes a good deal less. The patient may be confused and stupefied for several minutes.

The patient may bruise himself by falling against a hard surface.

Treatment.—Loosen the clothing about the chest and neck, and let the patient have plenty of air. Hold the tongue down with a spoon-handle, paper-knife, or some such thing. If the face becomes covered with perspiration bathe it with cold water.

Towards the end of the fit, when the muscles begin to relax, turn the face to the side, to prevent the tongue falling

too far backwards and interfering with the breathing; and if the breathing becomes "stertorous," the air being drawn in with difficulty, draw the tongue forwards.

If the fit lasts a long time, compress one of the carotid arteries with the thumb or tips of the fingers. If he remains very drowsy after the convulsions have passed off, let him finish his sleep.

Convulsions.—These are especially common in young children, and are caused by teething, worms, the presence of indigestible food in the stomach, constipation, and various acute diseases, such as fevers, pneumonia, and inflammation of the ear (earache).

They are always to be regarded as serious.

The attack is somewhat similar to epilepsy, but often lasts much longer.

There are certain important signs that give warning of an approaching seizure: these are restlessness, and especially a drawing of the thumb across the palm of the hand. This last sign should always induce the parent to seek the immediate aid of the medical adviser.

Treatment.—Loosen *all* the clothing and apply cold water to the head until the arrival of the doctor, who should be sent for immediately.

Apoplexy.—This is always a most serious disease, and perfect recovery is rare, even from a first attack. The patient is seldom much below sixty years of age. Apoplexy is caused by a blocking up or rupture of some blood-vessel in the brain. For some days before the attack the patient may have complained of a feeling of discomfort or fulness in the head.

The attack occurs suddenly. The patient becomes unconscious, though, if spoken to loudly, he appears to hear and will perhaps mutter some unintelligible words.

The breathing is *stertorous;* that is, both inspiration and expiration are noisy, as though there was some obstruction in the throat, and it will be noticed that at each expiration

one of the cheeks is puffed out and the mouth is drawn a little to the opposite side.

The eyes have a vacant stare, the pupils are unequal and insensible to light (that is, they do not contract normally when a bright light is brought near to them). There is paralysis (that is, loss of power of one side of the body). How are you to detect loss of muscular power in a patient who is unconscious? Raise the two arms a few inches and then let them drop. The paralysed arm drops like a dead weight, whilst the other one goes down more slowly, and when you raise it you can feel that it is offering some resistance, quite different in this respect to the paralysed arm. Do the same with the legs and you will find that the paralysed leg is on the same side of the body as the paralysed arm. The mouth also is drawn away from the paralysed side.

Treatment.—Keep the patient perfectly quiet. Apply cold to the head and hot-water bottles to the feet. Do not give him anything to drink. Above all, *avoid stimulants*.

Concussion of the brain.—This is caused by a fall or blow on the head. The patient instantly becomes more or less unconscious in proportion to the severity of the injury.

A child whilst at play falls and knocks its head, appears drowsy for a short time afterwards, and then recovers. This is a case of slight concussion. Every case, however slight, is to be regarded as serious and treated accordingly.

Treatment.—Let the patient lie down, and if he is breathing comfortably do not disturb him. It is necessary to recollect that there may be some actual injury, such as fracture of the skull, in addition to the injury to the brain, so that one has to be careful not to disturb the patient too much.

Shock or collapse.—This is caused by a severe injury to any part of the body, such as a crush, a blow over the stomach or heart, an extensive burn or scald, by fright, or

loss of a large quantity of blood. The symptoms closely resemble those of fainting and concussion of the brain. The skin, especially of the hands and feet, becomes cold, the pulse feeble and irregular; the face has an anxious expression. The patient does not recover from shock so rapidly as from an ordinary faint.

Treatment.—In addition to treating the cause, such as bleeding, you should apply a bag of hot salt or hot bran over the region of the heart, and a hot-water bottle or hot brick (wrapped in flannel) to the feet, and give the patient some brandy and water and hot coffee. If he cannot swallow, hold strong smelling salts to the nostrils. The whole body should be kept well covered with warm clothing.

Sunstroke.—The patient is unconscious. The face and neck are very flushed and hot, and the breathing is noisy.

Treatment.—Remove the patient into a cool shady place, allow plenty of air to play about him, loosen the clothing, and apply *abundance* of cold water to the head and neck.

Poisons.—Poisons are divided into two classes—

1. Narcotic poisons.
2. Irritant poisons.

1. **Narcotic poisons** are those substances which rapidly produce more or less unconsciousness without burning or irritating the mouth, throat, or stomach. The patient takes a dose and perhaps feels no ill effects until he begins to get drowsy, the drowsiness gradually increasing until it ends in complete insensibility, a condition known by the term "coma."

As examples of narcotic poisons we may select the two commonest, alcohol and opium.

Alcohol is a powerful narcotic. A man deeply under its influence is said to be drunk. In most cases he can be roused up, but gives stupid answers and is unable to control his movements. In the more severe cases he is *quite* unconscious, and all voluntary movement is lost. The

breathing may be stertorous as in apoplexy, but the face is very pale and dusky in colour, and the mouth is not drawn to one side. The pupils are both dilated. The pulse is very feeble. The skin feels cold and clammy, and if the temperature be taken with a thermometer it will be found several degrees below the normal. The breathing is slow and shallow, and the breath smells of alcohol.

A case presenting such symptoms requires very prompt treatment to prevent a fatal termination.

Treatment.—In all cases of narcotic poisoning you should give the patient an "*emetic*," that is, something to produce *vomiting*, the most convenient being a tablespoonful of salt or mustard in a tumblerful of warm water. Warm water alone will generally produce vomiting if given in large quantities, and it will, at any rate, serve to dilute any poison still remaining in the stomach, and so retard its absorption into the blood. But it would not be wise in any case to trust to warm water alone.

The following are very good emetics: ipecacuanha wine, one teaspoonful every two or three minutes until vomiting occurs. Sulphate of zinc, 20 grains (half a teaspoonful) in a wineglassful of water acts very promptly. It is one of the surest emetics we know of.

Sometimes it may not be possible to procure any one of these things quickly enough. What is to be done then? You may often succeed in producing vomiting by tickling the inside of the throat with a feather, and failing this, you should pass the first finger of your right hand well to the back of the mouth.

If it is a long time since the alcohol has been taken there may be very little of it in the stomach, so that vomiting will not get rid of the poison.

Whilst you are trying to bring on sickness you should get some one to procure warm clothing for the patient, as well as hot things to apply to the feet and over the heart as mentioned when speaking of "shock" (page 65).

Dashing cold water on the face with the end of a towel has often a remarkably good effect in rousing the patient from his stupor.

After an emetic has acted freely, give the patient plenty of strong coffee.

Alcoholic poisoning occurs from drinking brandy, whisky, and other strong spirits, spirits of wine, Eau de Cologne, &c.

It must not be forgotten that a drunken man may also be suffering from apoplexy, or he may have fallen down and fractured the skull. You should be on the lookout for such conditions as these, for the treatment to be adopted would then be very different to that for uncomplicated alcoholic poisoning. If you suspect that apoplexy has occurred in a person who is also under the influence of alcohol, you had better avoid emetics and all other energetic treatment and do as you would in an ordinary case of apoplexy. The straining that occurs in vomiting would certainly, in a case of apoplexy, lessen the patient's chances of recovery.

Opium poisoning.—Opium is taken in several forms, most frequently in the form of tincture (popularly called laudanum), and morphia, or morphina—a substance prepared from solid opium.

They all produce practically the same effect on the body, morphina being the most powerful.

After a poisonous dose has been taken the patient soon feels drowsy, and he falls into a sleep which rapidly becomes deeper and deeper, and finally ends in profound coma unless suitable treatment be at once adopted.

There is one sign specially characteristic of opium poisoning, and is always seen after a full dose has been taken; this is great contraction of the *pupil* (the black centre of the eye). Look at Fig. 47, and observe how small the pupil is in the opium eye compared with the eyes of the patient before the taking of opium. Of course, in opium-poisoning *both* pupils are contracted.

Treatment.—Give an emetic, and get the patient to vomit as soon as possible. *He* must *be roused up* by shaking, shouting at, and dashing cold water in his face with the end of a towel. As soon as he has been sick he must be made to walk about, being supported by two men, one at each side, until the sleepiness passes off and the pupils begin to get a little larger. He must not be allowed a long rest until you feel sure that he is out of danger, as, for a long time after he has begun to speak, and to declare (often in very forcible language) that he is "all right



Natural eye. FIG. 47. Opium eye.

now," he will soon fall into a profound sleep if not interfered with.

Give strong hot coffee frequently from the first. If the breathing is very shallow, and the hands and lips bluish, "artificial respiration" should be performed (see page 72).

It may be necessary to use the "stomach pump," but this can only be done by the medical man, who should be called to the case as soon as possible.

Other narcotics are: *Belladonna*, *Henbane*, *Prussic Acid*, *Chloroform*, and cases of poisoning by any one of them may need to be treated by stimulants, artificial respiration, and, except in the case of chloroform, of emetics.

Wherever there is great *prostration* give stimulants (coffee and brandy). Whenever the breathing is very slow and shallow, adopt *artificial respiration*.

If there is any likelihood that some of the poison still remains in the stomach, give an emetic, and if the patient is cold, apply artificial heat.

Some poisons cause *delirium* long before the stage of coma is reached, but it is not necessary to go into further detail on the subject.

II. **Irritant poisons** are substances which irritate, corrode, burn, or destroy all those parts of the body with which they come into contact, so that the patient, *as soon as the poison has been taken*, experiences an intense burning or smarting pain in the mouth, throat, and as far as the poison has penetrated. There are often marks of the poison on the lips. If much has been taken, he rapidly gets into a condition of collapse or shock (see page 64), and may die very soon from exhaustion.

There are two great classes of irritant poisons, differing not so much in their effect as in the treatment required.

These two classes are **acids** and **alkalies.** If you will get some vinegar and some carbonate of soda, and mix the two together, you will observe that they act upon one another in a very striking manner. The soda will rapidly dissolve in the vinegar, and great quantities of bubbles of gas will be given off—the mixture will effervesce. Now the vinegar is an *acid*, though not a poisonous one, and the carbonate of soda may be taken as an example of an alkali. The important thing to remember is that when an acid and an alkali are mixed together, they *neutralise* one another, and a substance is formed differing in properties from both, and having in many instances no poisonous action.

This fact indicates what treatment should be adopted in a case of irritant poisoning. If the poison is an acid, you must give the patient an alkali. If the poison is an alkali, you must give the patient an acid.

Nitric acid ("aqua fortis"), hydrochloric or muriatic acid ("spirit of salt"), and sulphuric acid ("oil of vitriol") are examples of acids that sometimes cause death.

Poisonous alkalies are caustic soda and caustic potash.

Treatment.—If an acid has been taken, give plenty of alkaline substances, such as magnesia, powdered chalk, whiting, carbonate of soda, and if none of these is at hand, scrape some plaster off the kitchen wall or ceiling, mix it quickly with water or milk, and give to the patient.

The *first* thing to attempt is to neutralise the poison.



FIG. 48.—Artificial respiration. (Sylvester's method. First position.)

The next thing is to soothe the pain; and this is best done by letting the patient drink milk, flour and water, thick barley-water, linseed tea, olive oil, or yolk of egg.

At the same time you must combat the tendency to collapse by applying warmth to the feet, &c.

For poisoning by strong *alkalies* you must give some dilute acid. The best acids are vinegar, citric acid, and tartaric acid.

Should an emetic be given? Certainly not. An emetic

must never be given in poisoning by any of the acids or alkalies just mentioned. In other words, an emetic *should* be given for all poisons that *do not* burn the part they come into contact with.

There is one poison that needs special mention, viz., *carbolic acid*. Poisoning by this substance should be treated by an emetic, as well as soothing drinks, such as those already mentioned.

Decomposing food often produces symptoms of poison-



FIG. 49.—Artificial respiration. (Sylvester's method. Second position.)

ing. If they are detected before the food has all left the stomach an emetic should be administered.

Asphyxia or Suffocation.—This is produced most frequently by one of two causes—

1. Inhalation of poisonous gas.
2. Obstruction to the passage of air to and from the lungs.

1. **Suffocation by gas** occurs from breathing coal gas

(as from a leaking gas-pipe), and carbonic acid gas, after explosions in coal-mines, &c.

Carbonic acid is being continuously formed within our bodies, and indeed within the bodies of all animals. It is given off from our lungs with each breath. If it is allowed to accumulate in a room beyond a certain amount, as it is apt to do if the ventilation is imperfect, the air becomes very poisonous, and therefore unfit for respiration.

Treatment of gas poisoning.—First get the patient taken into the fresh air, if it is possible. If this cannot possibly be done, then all windows and doors must be thrown wide open; and if the window will not open, the panes of glass must be broken, so as to admit fresh air.

All clothing about the neck, chest, and waist must be loosened.

If the patient is unconscious, dash cold water on the face and chest.

If breathing has ceased, or is very shallow, artificial respiration must be commenced *at once*, and the doctor sent for.

Artificial Respiration can be accomplished by various methods, the simplest and perhaps the best for gas poisoning being that known as "**Sylvester's Method.**"

It is performed as follows: Lay the patient on his back on the floor, with a thick pad, such as can be formed by a tightly-folded coat, underneath the *shoulders* (not under the neck).

Loosen all clothing about the neck, chest, and waist, as well as braces or shoulder-straps.

Kneel on the floor, behind the patient's head; grasp both his arms below the elbows, and bring them up together, pulling them above the head, and making the forearms touch the ground.

This procedure will put the muscles that are attached to the arms and the chest on the stretch, and thus draw the ribs upwards. The chest by this means is forcibly ex-

panded or enlarged, and *air is drawn in*. This movement imitates *inspiration*. Next, the arms must be brought forwards, crossed over the lower part of the chest, and the chest pressed, so as to force out as much air as possible. This movement imitates *expiration*.

This alternating up and down movement is to be performed at about the same rate as in ordinary breathing, namely, eighteen times in a minute. A good plan is to count *two* rather slowly at the end of the up and of the down movement, thus: up "one, two," down "one, two," up "one, two," down "one, two," and so on.

Whilst *you* are performing artificial respiration, you should get some one else to dash cold and warm water alternately on the patient's face and chest, and to use strong smelling salts.

During asphyxia the patient's skin is blue and cold, and real signs of improvement will be a return of the natural colour to the face, increased warmth of the surface, and attempts at natural breathing.

You must continue artificial respiration until all these favourable signs appear. Sometimes it is necessary to persevere for *two hours*.

You must help the return of warmth by applying hot blankets to the whole surface of the trunk and legs. As soon as the patient begins to breathe naturally, friction should be applied to the limbs. How? They must be rubbed *towards* the heart in order to assist the return of the venous blood. This must *not* be done *before* natural breathing has commenced, for until then the heart is too full of blood and would be still more distressed by a greater supply.

As soon as the patient can swallow, give hot coffee and a little brandy and water.

2. **Obstruction to the passage of air to the lungs** may be caused by—

(*a*) Some solid substance in the throat and windpipe.
(*b*) Water in the windpipe and lungs.

(*a*) A piece of meat too large to swallow may stick in the upper part of the throat and obstruct the opening of the windpipe which communicates with the throat. Particles of food are sometimes drawn into the windpipe through laughing whilst food is in the mouth.

Treatment.—Beat the back of the patient's chest just between the shoulders. If this does not move the obstruction, pass your forefinger well to the back of the mouth and



FIG. 50.—Artificial respiration for restoring the apparently drowned. (Marshall Hall's method. First position.)

keep it there until the patient makes strong attempts at, or actually does, vomit. If this does not relieve the breathing, quickly send for a surgeon with a message as to the nature of the case.

(*b*) **Drowning.**—Here the patient is often apparently dead when taken out of the water, and yet may be restored if proper means be *promptly* adopted.

Treatment.—As his chest is full of water, this must as far as possible be got rid of before anything else is done. How

are you to do this? First of all turn the patient right over on to his *face*, with the head and shoulders as low as possible. Whilst in this position clear the mouth and throat of any foreign substance such as mud or weeds, and press the back and sides of the chest *firmly* so as to expel the water as far as possible. Draw the tongue well out of the



FIG. 51.—Artificial respiration. (Marshall Hall's method. Second position.)

mouth and secure it with an elastic band or piece of string passed over it and under the lower jaw, or get some one to hold it out with a handkerchief.

Then roll the patient on to his *back* and perform artificial respiration exactly as for gas poisoning. But as no water can escape from the chest whilst the patient is lying on his back, it will be necessary occasionally, say once every

two minutes, to roll him over, face downwards, as at the beginning.

In addition to this *warm* dry clothing must be procured, either from bystanders or neighbouring houses, to replace the patient's wet clothes, changing them as opportunity occurs without interfering with your efforts to restore breathing.

Warm things must also be applied to the feet, and a flannel wrung out in *hot* water should be applied over the heart.



FIG. 52.—Artificial respiration. (Marshall Hall's method. Third position.)

As soon as the patient begins to breathe by himself, but not before, the limbs must be rubbed upwards as already described. Give stimulants as soon as the patient can swallow.

After a while the patient may be allowed to sleep in bed or on a couch, well wrapped in warm clothing, but his breathing must be watched, and if it seems to be stopping artificial respiration must be recommenced.

The great advantage of Sylvester's method is that it can be performed by *one* person alone. If, however, there be two others at hand to help you, it may be better to adopt

Marshall Hall's method of artificial respiration.

First loosen all clothing, as in Sylvester's method.

Let one assistant kneel at the patient's head, the other at his feet, whilst you kneel at his *left* side (as he lies on his



FIG. 53.—Artificial respiration. (Marshall Hall's method. Fourth position.)

back). The two men are to assist in rolling him backwards and forwards, first on his *face*, then on his *side*. The patient's head must be protected during the rolling process by having his right forearm pressed against his forehead by the assistant's right hand, who at the same time supports and protects the head with his left hand (Fig. 50).

You should grasp the patient's left arm near the elbow.

Now roll him on to his face. Place a pad (folded coat) under his chest, and then press the chest so as to expel the water.

Next turn him on to his right side (*not* his back), and at the same time raise his arm from the chest (Fig. 51). This will help it to expand and to draw in air. Then again turn him on to his face, and so on. This backward and forward movement must be continued at the rate of fifteen to eighteen times in a minute.

Students in practising this method often make the mistake of rolling the patient from his face on to his *back*, instead of only on to his side.

So far you have attempted to clear the water from the *left* lung — the one uppermost when the patient is on his side. So you must now go over to the other side of the patient, and continue the rolling movements, from the face to the left side, in order to clear the *right* lung, the assistants making corresponding changes, the patient's *left* forearm being now held against his forehead (Figs. 52 and 53).

As in Sylvester's method, these movements must be continued for at least *two hours*, if natural breathing is not established sooner.

PART II.

(*To be studied at the same time as Part I.*)

The Triangular Bandage (see figure and description on page 23) can be applied to any part of the body. Professor Esmarch has drawn special attention to the use of this bandage. Sometimes it is applied the full width, as in the large arm sling, or it may be folded to make a broad or narrow bandage.

To make *the broad bandage*, bring the point to the

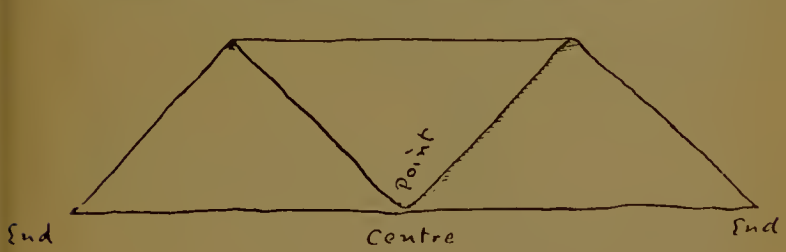


FIG. 54.

centre of the lower border (Fig. 54), and fold it once again in the same direction. This is used for

Small arm sling (Fig. 59).

Fracture of ribs (Fig. 42).

Fracture of thigh (Fig. 43). To go round the chest and the long splint.

To make *the narrow bandage*, fold the broad bandage once more.

It is used to secure the pad over a wound (Fig. 34).
To go round the head (Fig. 17).
To secure splints (Fig. 46).
For the tourniquet, knotted (Figs. 13 and 28).

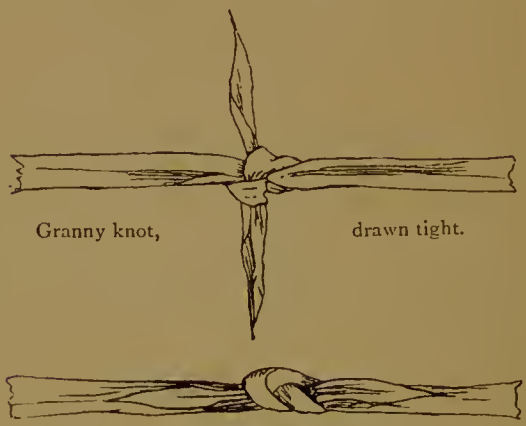


FIG. 55.—Reef twist, drawn tight.

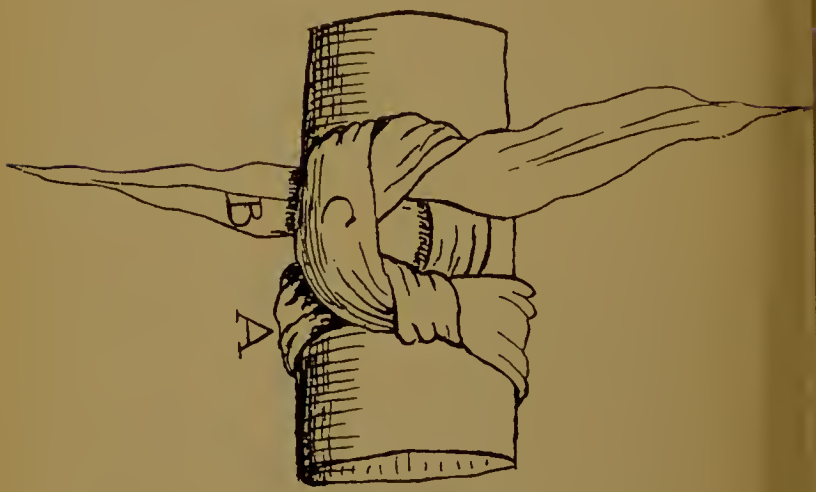


FIG. 56.—Reef knot.

The ends must be secured by a *Reef knot*, which is much less likely to come undone than the common or "granny" knot, and, as a rule, looks neater (Fig. 55).

Tie the first half of the knot in your usual way, then tie the second half in the *reverse* direction (Fig. 56).

In the common knot both halves of the knot are made in the same way (Fig. 57). Look at Fig. 56, and notice that the loop C crosses both A and B on the side next you, whereas it crosses over A and dips under B in Fig. 57.

For the Tourniquet see page 24.

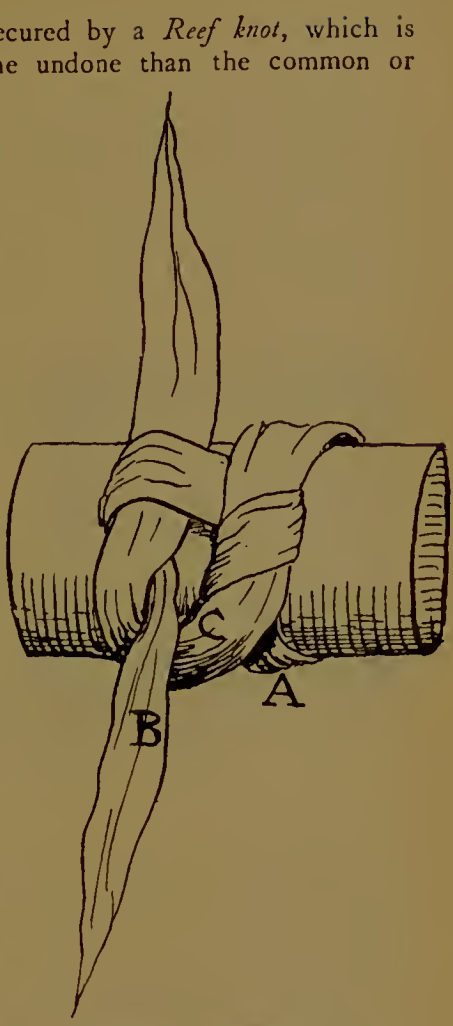


FIG. 57.—Granny knot.

The Capelline Bandage (Fig. 58) is used to cover the whole top of the head, to secure dressings on wounds, but is not used to arrest hæmorrhage.

Stand behind the patient; place the *centre* of the bandage between his eyebrows, letting the point hang down behind; bring the *ends* behind, crossing just over the point, and tie them in front over the eyebrows. The bandage should touch, but not cover, the ears.

Turn the point up and secure with a safety-pin on the top of the head.

Feel that the bandage is tight enough to be secure.

Large Arm Sling (Fig. 60).—Stand in front of the patient; place one end of the bandage over the shoulder of the *sound* side. The forearm of the injured side is drawn across the chest in front of the bandage, so that the *point* is on a level with the elbow; bring up the other end of the bandage in front of the arm and over the shoulder of the *injured* side, and tie the two ends together behind the neck, but a little to one side, so that the patient will not rest against the knot when lying down. The point should be drawn round the elbow and secured as in Fig. 60. This sling is used for Fracture of the Collar-bone, Fracture of the Forearm or Hand, or any other condition requiring the whole limb to be supported.



Fig. 58.—The Capelline bandage.

Small Arm Sling (Fig. 59).—This sling only supports the wrist and hand. Make the broad bandage (page 79), and apply as shown in Fig. 59. This is used especially for fracture of the bone of the upper arm.

Shoulder Bandage.—Fold back the lower edge of the bandage. Place the centre on the outer side of the upper arm, with the point towards the neck and the ends round the arm; now apply a "small arm sling" to the same side (Fig. 61), and draw the point of the first bandage

over it and secure with a safety-pin. This bandage is used for securing poultices or other dressings to the shoulder.

The Hand Bandage.—Place the hand on the ban-



Fig. 59.—The small arm sling.

dage, palm downwards, the wrist lying over the centre, and the fingers directed towards the point. Fold the point over the back of the hand, and secure it by tying the ends round

Fig. 60.—The large arm sling.

Fig. 61.—The shoulder bandage.



FIG. 62.—The chest bandage. The "point" goes over the shoulder.



FIG. 63.—Back view of chest bandage seen in Fig. 62.

the wrist. It is used to secure dressings or poultices.

Chest Bandage. — Back or front (Figs. 62 and 63). Spread the bandage over the chest with the *point* over the shoulder; pass the ends under the arms round the chest, and tie them together, leaving one end long enough to reach and be secured to the point. It is used to secure dressings, &c., on the front or back of the chest.

Hip Bandage (Fig. 64). — Pass the bandage round the thigh in the same manner as round the arm for the shoulder bandage, keeping the point up towards the waist. Then pass a narrow bandage round the waist, draw the point of the first bandage under it, turn it over, and secure with a safety-pin.



FIG. 64.—The hip bandage.



FIG. 65.—The foot bandage.

Foot Bandage (Fig. 65). —Place the sole of the foot

on the bandage, with the toes directed to the point. Bring the point up above the front of the ankle. Cross the ends over the instep, including the point, then under the foot and over again, and tie behind the ankle.

CARRYING PATIENTS

In all cases of fracture requiring splints, they should when practicable be applied and fixed before the patient



FIG. 66.—The two-handed seat.

is lifted up or placed on a stretcher. If the leg be broken, and he *must* be moved before any splint can

be applied, tie the two legs together in three or four places.

Improvised Hand Seats.—Two-handed seat.—When the patient is unable to render assistance, the two bearers must bend down, one on each side of the patient, and pass one pair of hands under his hips, and either



FIG. 67.—The four-handed seat.

lock the fingers together or grasp one another's wrists (Fig. 66)

Each bearer must pass his other hand under the upper part of the patient's back, and grasp the shoulder of the other bearer. Don't lift until you feel that the patient is quite securely seated on your locked hands.

If the patient is conscious, and can assist by placing

his arms round the bearers' necks (especially if he be a heavy man), it is best to make a

Four-handed seat.—The bearers stand facing one another, and each grasps his own left wrist with his right hand (or each may grasp the right wrist with the left hand),



FIG. 68.—The three-handed seat.

and with the free hand grasp the free wrist of his fellow-bearer (Fig. 67).

The three-handed seat is made by one bearer, instead of grasping his own wrist, grasping the free wrist of the other bearer, and placing his free hand on his fellow's shoulder, in order to support the patient's back (Figs. 68 and 69).

Stretchers for carrying patients can be made of sacks and poles, or a shutter, gate, or door may be used.

You can make a very useful stretcher by passing two poles into a sack and letting them go through the bottom of it, one at each corner, as in Fig. 70.

A coat that buttons all the way down may be used thus: turn the sleeves inside out and then button up the



FIG. 69.—Patient carried on the three-handed seat.

coat; the sleeves being *inside*. Pass a pole through each sleeve, and the coat will form a support on which the patient can be placed, though if the patient be other than a small child, *two* coats will have to be used, one in a line with the other.

In cases of fracture, splints should be applied to the injured part *before* a patient is lifted from the ground to be placed on the stretcher.

The two stretcher bearers should be as nearly as possible of the same height in order to keep the patient horizontal.

The stretcher must never be carried on the shoulders.

STRETCHER EXERCISE.

In order that the use of the stretcher may be quickly and thoroughly learned, a class must be *drilled* in the use of it. The following drill and exercise is copied by permission of the St. John Ambulance Association from Shepherd's "First Aid to the Injured." It could not

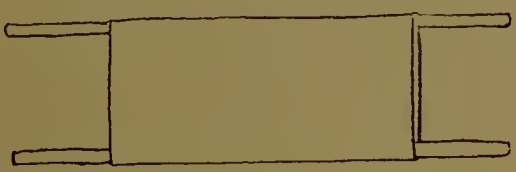


FIG. 70.—Sack stretcher.

be explained in clearer language, and it is well for *all* ambulance classes to learn one uniform drill.

Exercise No. I.—For three bearers: To be used when space will allow.

1. The instructor selects the bearers and numbers them 1, 2, 3 at his discretion. Should one man be taller and stronger than the others, he should be styled No. 1, as he will have to bear the heavier part of the burden.

All orders are to be given by No. 3.

2. "Place the stretcher."

No. 1 taking the head of the stretcher and No. 2 the foot, place it in a line with the patient's body, the foot of the stretcher being close to his head.

No. 3 attends to the patient, assisted by Nos. 1 and 2 when necessary.

3. "Fall in." At this order

No. 1 places himself at the patient's right side.

No. 2 at his left side, and both bearers face each other.

No. 3 takes position on the injured side in a line with the patient's knees.

Note.—The duty of No. 3 will be entirely to look after the injured part of the patient's body or limbs, to see that no bandages or splints become displaced, and also that No. 2 bearer in lifting or carrying does not in any way touch the patient's feet.



FIG. 71.—See Stretcher drill, I., No. 4, "Ready."

When everything has been arranged for the removal of the patient, the order will be given—

4. "Ready." (See Fig. 71.)

Nos. 1 and 2 now each sink down on one knee and grasp each other's hands under the shoulders and thighs of the patient, whilst No. 3 places his hands underneath the lower limbs, always taking care, in case of a fracture, to have one hand on each side of the seat of injury.

5. "Lift."
 All three bearers rise together to their feet, keeping the patient in a horizontal position.
6. "March."
 All take short side paces until the patient's head is over the pillow of the stretcher.
7. "Halt."
 All the bearers remain steady and wait for the next order.
8. "Lower."
 The patient is placed gently on the stretcher, and the bearers then stand up.
9. "Fall in." On this order being given—
 No. 1 places himself at the head of the stretcher with his face towards the patient, No. 2 at the foot with his back to the patient, and No. 3 places himself at the side of the patient.
10. "Ready."
 Nos. 1 and 2 stoop down and grasp the handles of the stretcher, having previously adjusted the shoulder-straps, in case they are used.
 No. 3, as soon as he sees all is right, gives the word—
11. "Lift." (See Fig. 72.)
 The stretcher is now raised to position ready for moving off, care being taken to keep the patient's head above the level of his feet.
12. "March." On this word being given,
 No. 1 steps off with his left foot, and No. 2 with the right.
 The step should be a short one of twenty inches, and taken with bent knees just from the hips.
13. "Halt."
 The place of destination being reached, on the word "Halt" being given, the bearers remain steady in position.

14. "Lower."

At this order the bearers place the stretcher on the ground, and then stand up, care being taken to let the patient's feet reach the ground before his head.



FIG. 72.—See Stretcher drill, I., No. 11, "Lift."

15. "Unload stretcher—Ready."

The bearers prepare to take the patient off the stretcher.

16. "Lift."

The bearers raise up the patient as before instructed.

17. "Lower."

The patient is carefully lowered upon the vehicle, bed, or other place, to which it has been designed to carry him.

Exercise No. II.—For four bearers: To be used when there is not sufficient space for carrying out Exercise No. I.

1. The instructor numbers the bearers—1, 2, 3, 4. All orders will be given by No. 4.
2. "Fall in."

 At the words "Fall in" Nos. 1, 2, and 3 take position on one side of the patient. No. 1 places himself at the patient's shoulder, No. 2



FIG. 73.—See Stretcher drill, II., No. 3, "Ready."

 near the middle of the body, No. 3 near the patient's feet. At the same time No. 4 places the stretcher on the ground by the other side of the patient, and remains standing near its centre, facing the other bearers.
3. "Ready." (See Fig. 73.)

 Nos. 1, 2, and 3 stoop down and kneel on the left knee if they are on the left side of the patient, on the right knee if they are on the right side of the patient. Then they proceed

to take hold of the patient, No. 1 passing one of his arms beneath the patient's neck, and the other under his shoulder-blades; No. 2 passing both arms under the middle of his body, one above, the other below the buttocks; and No. 3 passing both arms under the lower extremities, excepting in case of fracture,



FIG. 74.—See Stretcher drill, II., No. 4, "Lift."

when he must place one hand on each side of the broken bone, so as to steady it. No. 4, when the word "Ready" is given, should place himself opposite No. 2, stoop down and lock his hands with No. 2 under the patient's body. If the patient be able to help, he should clasp his hands round the neck of No. 1.

4. "Lift." (See Fig. 74.)

On the word "Lift" the bearers raise the patient gently and rest him on their knees.

As soon as he is securely rested, No. 4 runs round by the head of the stretcher, and places it under the patient, being careful that the pillow is immediately under the patient's head; he then stoops down and locks his hands with those of No. 2.

5. "Lower."

At the word "Lower" Nos. 1, 2, and 3 carefully lower the patient down to the stretcher, while No. 4 at the same time assists in supporting and placing him on it.

6. "Stand to stretcher."

On this order being given each bearer stands up. No. 1 goes to the head of the stretcher, with his face towards the patient; No. 2 to the foot, with his back to the patient; while Nos. 3 and 4 remain in position on each side of the stretcher.

7. "Ready."

Nos. 1 and 2 grasp the handles of the stretcher, having previously adjusted their shoulder-straps, in case they are using them.

8. "Lift."

At this word Nos. 1 and 2 bearers raise the stretcher steadily together and stand up.

9. "March."

All being ascertained to be in order, on the word "March" being given, Nos. 1 and 2 bearers move off, No. 1 stepping off with his left foot, and No. 2 with his right foot. Nos. 3 and 4 march on each side of the stretcher. On arriving at the place of destination the following orders are successively given:—

10. "Halt."

11. "Lower."

12. "Unload stretcher—Ready."

13. "Lift."
14. "Lower."

N.B.—These orders, viz., Nos. 10 to 14 inclusive, are to be carried out in a similar manner to orders Nos. 13 to 17 in Exercise No. 1.

This way of lifting a patient may occasionally have to be done with only three bearers, who must all arrange themselves on one side of the patient, with the stretcher previously placed close to the other side of the patient.

After the patient is raised on to the bearers' knees, they must advance the foot of the supporting knee until it is close to the side of the stretcher, and then very carefully lower the patient on to it. It is, of course, much more difficult to do *carefully* this way than it is when there is a fourth bearer on the other side of the patient assisting to support him.

Whether descending or ascending a hill, the stretcher should be so carried that the patient's head is *not lower* than his feet. In going uphill let the head of the stretcher be in front; on going downhill the foot of the stretcher should be first. On a level road the foot of the stretcher should always go first; it is much more comfortable for the patient.

In conveying a patient any distance in a vehicle, such as can be procured in the country, great care must be taken to arrange matters so that the patient can lie full length, and without pressing the head or feet against any part of the conveyance—*i.e.*, of course, if the injury is at all serious, and especially where the leg is fractured. The patient must be laid on a stretcher, and underneath this must be a thick even layer of straw or hay, to prevent the jolting of the cart shaking the patient injuriously.

A man with a broken leg must never be put inside a cab.

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